the OIL AND GAS JOURNAL

JUNE 16, 1958

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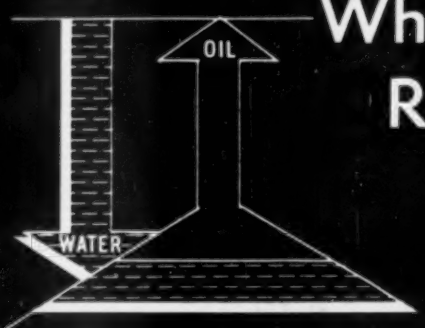

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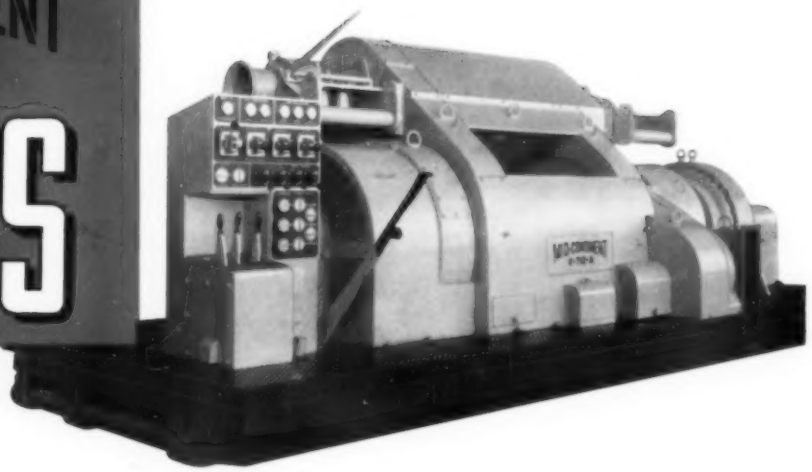
MID-CONTINENT NEWS



Mid-Continent Supply Co. introduces new drawworks:

New rig, the U-712-A, provides faster drilling through greater operational efficiency.

Featuring new single console, the U-712-A provides complete control of rig by driller. This is possible because speed selection levers and air actuated clutch controls are in new centrally-located panel.

U-712-A is manufactured by Unit Rig & Equipment Co. Rig is designed for medium depth drilling in 8,000-12,000 foot range.

Rig is rated at 700 to 1,200 net input horsepower, weighs approximately 43,750 pounds.

Single package unit contains hoisting drum, transmission, rotary drive, and auxiliary brake. Rig, less than ten feet wide, can be easily transported on the highway.

U-712-A features:

...All bearings are grease lubricated with flood lubrication provided for chains, sprockets, and splined clutches.

...Fawick VC clutches are mounted on the drum shaft for low and high drives. An emergency splined clutch is provided on the low drive.

...Large 48" diameter self-equalizing brakes are designed for rapid, drag-free release and smooth feed-off operation. Auxiliary brakes offered include Elmagco or Hydromatic.

...Main drum is 25" in diameter by 51½" long and provides less than three wrap spooling when hoisting 90 foot stands in an 8 line reaving system using 1¼" wire line.

For complete information, write for our U-712-A Bulletin or contact your local Mid-Continent representative.

DW2-8

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THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
June 16, 1958

New crude-import deals have inland refining men buzzing:

Sun Oil is moving 5,000 bbl. daily of Lake Maracaibo crude by tanker to Texas, then by pipeline across the U. S. into Sarnia. The crude is under bond throughout transit.

The crude moves from Sun's Gulf Coast terminal on the Neches River to its Mid-Valley terminal in East Texas. It moves over the Mid-Valley line to Lima, then by Buckeye to Toledo, by short line to the Ohio-Michigan line, and then by a Sun line to Sarnia.

Joint tariff adds up to 49½ cents per barrel, and the oil reportedly is delivered at Sarnia quite a bit under the cost of western Canadian crudes.

Rumors also involve: Standard of Ohio reportedly is considering the same kind of deal for its new Toledo plant... Magnolia, by reversing present lines in Texas, could deliver Venezuelan or even Middle East crude to its big-inch line in the Corsicana area and then move it north by connecting lines to affiliated Socony Mobil refineries...International Refineries is working out a deal under which Atlantic Refining will take International's Venezuelan-crude allowable at Philadelphia in exchange for Williston basin crude delivered by Atlantic to International's plant at Wrenshall, Minn.

A tough decision faces Capt. M. V. Carson before he can work out quotas for importers of unfinished products (p. 66).

He must first decide just what unfinished products are and then he must find out what the currently prevailing level of imports is so they can be held there.

What effect this move to curb imports of products will have on Senate fight this week on the reciprocal trade bill is hard to tell.

The House passed the bill last week minus any mandatory controls on imports. Administration forces, however, were aided by the gag rule on debate and amendments. The Senate has no such limits and a hard fight is predicted (p. 64).

Deep drilling stays in the news:

Oklahoma has a new depth record. Shell's 5 Rumberger in Elk City field is drilling below 20,426 ft. in an attempt to find what lies at the bottom of the Anadarko basin. Show of gas was found at 20,097 ft. (p. 65).

World's deepest hole, the Phillips' 1-EE University in Pecos County, Texas, is now ready to drill to 25,000 ft. It was halted at 22,919 ft. for a mammoth casing job. This consisted of 7⅝-in. casing to 10,996 ft. where the open hole began and 7-in. for the remaining 11,923 ft. (p. 61).

Georgia has a wildcat venture with target of 8,500 ft.

If carried that deep, it will be the deepest hole ever drilled in the state. If it's at least a 100-bbl. producer, there's a $250,000 bonus from the the state to be split among the land or royalty owners, the working interests, the drilling contractor and the men who actually work on the well.

Geologists welcome the test even if dry. It should give them vital subsurface information in southwestern Georgia, the most-likely-to-produce part of the state (p. 162).

Drillers now have available two new chemical mixtures to help seal off unwanted water in air or gas drilling.

They are a plastic slurry and a polymeric water gel, both being introduced by Halliburton Oil Well Cementing.

Researchers report:

...The plastic slurry is especially effective for water shutoff in fractured formations producing moderate to large amounts of water.

...The gel is best when water from a permeable formation or low-pressure zone is encountered.

Most significant discovery in northwestern Kansas in many years was officially completed last week on pump for 319 bbl. daily of oil from the Cherokee sand at 4,804-12 ft.

The Pennsylvanian pool opener is Phillips I Llanos, northeast of Goodland in Sherman County. The Cherokee sand is one of several Pennsylvanian zones that had commercial showings during tests of the well.

Fifth active producing area has been brought in for Ellis County in northwestern Oklahoma.

Magnolia's 1 Schoenhals is a gas-distillate discovery producing from four intervals in the Morrow-Pennsylvanian. Flow was 112 bbl. of distillate and 5,780 M.c.f. of gas daily through 24/64-in. choke.

Associated with Magnolia are Pan American, Sun, Cities Service, Hunt, and the G. H. Vaughn Estate.

Crude production in Canada may take a 50,000-60,000 bbl. daily jump in July, according to reports in Calgary.

Small additional increases ranging from 5,000-6,000 bbl. daily may be expected for August and September with average third-quarter yield of 475,000 bbl. daily.

Alberta will benefit most—about 45,000 bbl. daily in July. Saskatchewan will gain upwards of 5,000 bbl. daily with

Manitoba, British Columbia, and Northwest Territories holding at present levels.

Factors behind improved market outlook: Rising seasonal demand, completion of refinery turnarounds, improved inventories, move by Canadian refiners to use more domestic crude.

An interesting miscible-phase type of secondary recovery is being tried by Atlantic Refining in Slaughter field.

Atlantic currently is injecting 6,000 bbl. daily of propane into three input wells on the 1,247-acre H. T. Boyd lease. When this is completed, gas will be injected at rate of 3,500 M.c.f. daily for 2½ to 3 years. Then Atlantic will turn to water at rate of 6,000 bbl. daily.

Engineers believe the plan will bring up an added 47% of the oil in place (p. 68).

A repressuring program is planned for California's offshore producing area at Seal Beach.

Monterey plans to drill a pilot water-injection well on its 1,400-acre lease bordering subsidence jittery Long Beach.

Officials of Monterey think a flood at its lease probably will halt the present ½-in. annual earth sinking in the area. The lease is being developed from an artificial island a mile from shore. Twenty wells now are producing 2,300 bbl. daily from two zones on the lease.

New ground rules under which common-carrier lines must connect a well in Texas appear to be a major victory for the Texas independent producers (p. 59).

The order is written in general terms. At this stage neither producer nor pipeline can be certain of his ground pending actual test cases.

But here's how the new approach will work: If the Railroad Commission believes evidence justifies the application for a connection, it will order the pipeline to connect the well. Also in some cases it can order the common purchaser to buy it.

Look for Acylfining to make its bow soon.

It's a new chemical-treating process developed for deodorizing solvents and for improving stability of light cycle oils. Developed by a Gulf Coast researcher, the process is being taken over by a national firm.

Here's a compelling reason why the octane race may slow down: When compression ratios go much above 9.5:1 motor noises develop that octanes don't correct.

And compression ratios apparently are headed up. Two General Motors engineers told SAE last week that maximum thermal efficiency is reached at ratio of 17:1.

Instead of higher octanes, corrective steps may be better engine oils, additives, and tailored fuels.

Refiners are getting nowhere in trying to rate fuels accurately above the 100-octane level by conventional means.

Fuel-research circles say an error of one octane number costs the industry well over a quarter million dollars every day. Because of inability to blend precisely, a product is achieved more potent than necessary.

Feeling is growing that a strong research effort toward reducing this margin of error is needed immediately.

Some believe we need to take a completely new approach to rating 100-plus fuels. Others hold we can improve accuracy by adapting the research method to the new problems presented by high compression ratios.

Sign of the times: Eastern Airlines, one of the big air operators with 188 planes, has just taken delivery of its last piston-powered plane.

Next addition to the fleet will be a Lockheed Electra turboprop. That will make Eastern a jet-fuel buyer and signal the eventual decline of its purchases of avgas.

About 10% of the U. S. market for passenger cars is being filled by imports and the one U. S. economy car, the Rambler.

Their combined 1958 sales are expected to hit 500,000.

That's big enough to interest Detroit's big three and is the explanation for reports at least Ford and Chevrolet will be out with their economy versions for the 1960 model.

But auto makers still are betting the bulk of their business will be the bigger, more powerful models.

Plans to increase avgas taxes may die in Congress.

Administration plan was to eliminate present 1-cent tax refund to airlines, add a half cent and increase tax on gas at rate of ¾ cent annually until levy reached 6½ cents.

Other aviation fuels would be taxed 3½ cents per gallon. and increased each year until the 6½-cent level was reached.

Object was to raise funds for airways improvements. But since enabling law for this work has not yet been introduced and congressmen are anxious to wind up current session, it's nearly certain there will be no action on the aviation taxes.

Seminars on how to conduct stockholders' meetings are being urged for company officials by the business analyst for National Association of Credit Men.

Growing attendance of hecklers at stockholders' meetings to gain publicity or to free load on the luncheons is a challenge to management to:

...Insure attendance by those actually interested in company's welfare and having a reasonable investment.

...Devise ways to expose the pro hecklers.

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Good Wells Make Good News

A Monthly Report of Successful Well Treatments

June 16, 1958

More and more operators are finding that acidizing can be their best well stimulation "buy." With Dowell's wide variety of acids and addition agents, you can select the service best suited to *your* well problem. Here are some interesting examples of recent Dowell acidizing treatments and their results:

- **St. Mary's Parish, South Louisiana.** (New Oil Well) This well was completed through 34 feet of perforations in the Miocene sand just below 13,800 feet. The well could not be swabbed in. Since permeability and porosity were high, operator suspected formation contamination from heavy mud. He ordered a 3000-gallon Mud Acid treatment. *After treatment, well came in without swabbing and is now producing 134 bopd which is top allowable for this field.*

- **Alberta, Canada.** (Old Oil Well) This well was completed through perforations into the D-2 formation between 5224 and 5260 feet. Production had declined, after a fracturing job, to six bopd. The operator decided to use a 2000-gallon Retarded Acid treatment followed by 2000 gallons of a mixture of crude oil and Freflo®. The well was shut in for 12 hours and then put on production. *After three months, production is still 48 bopd.*

- **Hansford County, Texas Panhandle.** (New Oil Well) This well was completed in the Atoka lime through perforations from 7086 feet to 7116 feet. There was no test before stimulation. Treatment was in two stages, using a total of 7000 gallons Dowell regular acid with both surface-tension-reducing and demulsifying agents added. *Two and a half months after treatment, well is making 395 bopd.*

- **Hardin County, Texas Gulf Coast.** (Old Gas Well) Production from this well, drilled in the Cook Mountain formation, had declined to one mmcfd with 40 bbls. distillate. Tubing pressure had dropped to 1200 psi. A workover failed to help the well. Dowell recommended a mud removal treatment using 1000 gallons Super Mud Acid, followed by a wash with 1000 gallons regular acid. A special silicate control agent was added to both acids. Following treatment the well cleaned up fast. *Production increased to 2.6 mmcfd with 124 bbls. distillate, and tubing pressure rose to 2600 psi.*

When you specify Dowell for acidizing you get the benefit of more years of experience in oil well acidizing than you can get from any other service company. For service, call any of the 165 Dowell service points and offices. In Canada, contact Dowell of Canada, Ltd.; in Venezuela, contact United Oilwell Service. Or write Dowell, Tulsa 1, Oklahoma.

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the OIL AND GAS JOURNAL

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
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TECHNOLOGY–OPERATION

Refining-Processing

Instruments for Heater-Oil Production 100

By S. F. Kapff and J. C. Rhodes

The continuous flash-point recorder and the simplified end-point apparatus help boost heater-oil production during the seasons of the year when there is an economic incentive to do so. They help keep distillation range of the heater oil as broad as the specifications allow and the fractionations as sharp as possible.

Modified Benedict-Webb-Rubin Equation Predicts PVT Behavior for Similar Gases . . . 105

By S. R. Darin, E. B. Stuart, and James Coull

The precision of the original equation is not utilized in many engineering applications because of the inconvenience of its use. Here is a reduced form which may be used for a group of similar gases and a compressibility chart using the reduced equation is presented.

Process Costimating 125

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Drilling-Production

Water-Flood Oil Recovery Lessened by Restricting Rates 88

By J. F. Buckwalter, G. H. Edgerton, W. E. Stiles, R. C. Earlougher, G. L. Buckles, and P. M. Bridges

These authors think that the effect of restricting rates on oil recovery by water flooding is damaging, and that ultimate oil recovery is reduced. The aim of the authors is: (1) To determine the actual quantity of oil attributable to water flooding which is produced in several states; (2) To show the economic effects of restricting of water-flood oil production; (3) To demonstrate losses of oil production by restriction; and (4) To discuss the findings of several laboratory studies on this subject.

Planning a 24,000-ft. Test 108

By Norman S. Morrisey

Howell & Howell, Dallas, is currently drilling below 16,000 ft. in an effort to reach and test the Bromide sand and the Arbuckle limestone on the Fort Cobb anticline in Caddo County, Oklahoma. The Bromide sand is expected at 20,000 ft. and the Arbuckle limestone at 21,000 ft. A specially designed 25,000-ft. rig was purchased for this test.

Field Processing—52: Principles of Gas Compression 122

By John M. Campbell

The increased volume of gas handled on the lease has made it necessary for the production engineer to be familiar with the principles of gas compression. This involves proper utilization of existing equipment as well as an understanding of the quotations and specifications set up by compressor vendors.

Pipelining

Weld Defects Avoided or Detected by Improved Field Welding and Quality Control 113

By A. G. Barkow

Improved equipment, methods, and tests, controlled by rigid standards have changed pipeline welding from an art to a science. This has made pipelines more durable and dependable.

On The Job . . . Pipelining: More on Slurry Pipelines 127

By John H. Henderson, Jr.

American Gilsonite's slurry pipeline from eastern Utah to Grand Junction, Colo., has now been operated for more than a year. The first 170,000 tons was handled at a current out-of-pocket expense of 2.5 cents per ton-mile. Volumetric efficiency is around 95%.

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NEW ELECTRIC INDUCTION HEATING PROCESS IN FORGING

UNRETOUCHED PHOTOGRAPH OF PRIMARY FORGING

Electric-induction coil with fully automated controls for heating rod end shown above.

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2. Automated controls govern predetermined progression, cycles, and temperatures throughout — permitting *multiplication* of inspections in process.

THESE ARE BUT *TWO* OF THE FEATURES IN THIS NEW NORRIS TECHNOLOGY. OTHERS WILL BE DESCRIBED IN SERIES TO FOLLOW.

W. C. NORRIS, MANUFACTURER

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WEST COAST DIS.: REPUBLIC SUPPLY CO. OF CALIFORNIA, LOS ANGELES

BEFORE FOA-2: This picture shows a typical instance of nozzle fouling caused by sludge.

AFTER ADDING FOA-2: Nozzles stay clean, burner operation is improved; tank contents remain free of sediment.

Du Pont FOA-2 solves sludge problem in refinery heating plant

By WILLIAM deB. BERTOLETTE

Maybe you or your customers have been forced to have fuel oil storage tanks cleaned to get rid of quantities of sludge. With proper treatment this sludge could have been dispersed and burned with the fuel.

For instance, the heating plant of a midwest refinery was using residual fuel containing 40% BS&W, with a very high solids content. Time after time, the storage tank had to be cleaned out to prevent nozzles from clogging and burners from flaming out.

Recently, following a clean-out, Du Pont's Fuel Oil Additive No. 2 (FOA-2) was added to the incoming oil stream in an effort to disperse sludge residue and stabilize the fresh oil supply.

The results were gratifying. After the additive had been used for three weeks, no sludge could be detected in the storage tank.

Effect on the burners

Examination showed the flame pattern was better, there were fewer ash deposits in the furnace, and overall burner operation was improved. (FOA-2 itself leaves no ash at all.)

The dispersing, stabilizing and solubilizing qualities of FOA-2 produced this money-saving improvement. Perhaps this instance suggests a way to improve the distillate fuel oils you sell or use yourself.

We recently published a book about FOA-2, containing all the basic information you need to consider the product. It describes composition and properties, also use concentrations, handling and addition methods, performance testing, and applications. Write us for a copy, or contact your nearest Du Pont Petroleum Chemicals sales office. E. I. DU PONT DE NEMOURS & CO. (INC.), Petroleum Chemicals Division, Wilmington 98, Delaware.

Wm. deB. BERTOLETTE, the author of this article, is technical service supervisor of the fuel oil group at Du Pont's Petroleum Laboratory. For over 20 years he has been closely associated with Du Pont's petroleum additives work.

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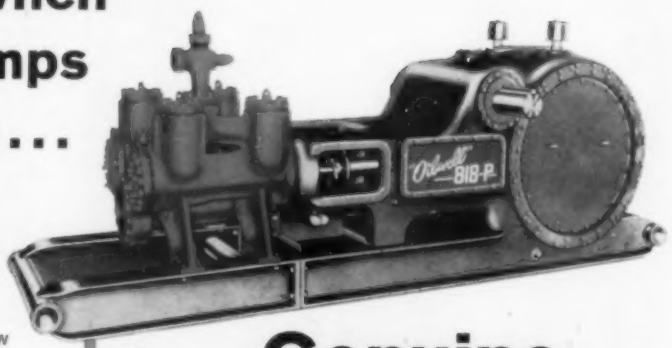

Pistons are the new "4-on-1" Wilson-Snyder design with the never-wear-out piston body which will take four different sizes of piston rubbers.

DI-HARD Liners have that exclusive armored lining of patented DI-HARD metal which gives greater service life, but for which you pay no premium.

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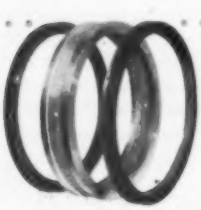

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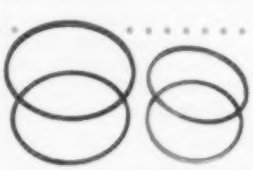

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extra hazardous fires need

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Write for your complimentary copy today. Grinnell Company, Inc., 277 West Exchange St., Providence, R. I.

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- Carbon Dioxide Systems
- Dry Chemical Systems
- Control Equipment and Devices
- Quick Selector Chart
- Research and Testing
- Sales, Engineering, Installation and Inspection Service

GRINNELL

WHENEVER FIRE PROTECTION IS INVOLVED

Manufacturing, Engineering, and Installation of Fire Protection Systems since 1870

"WHO...*us in the fertilizer business?*"

"Why of course gentlemen. It is the fastest growing industry in America. Other profit-minded businessmen have gone into the production of complex fertilizer because of the rapid pay-out time on plants of this type. These plants are now turning out thousands of tons of this new fertilizer, both in this country and abroad, for a constantly increasing and permanent market. Only once in the past 40 years (1930-32) has consumption of commercial plant foods declined or held stable for more than a one year period. Only once in 18 years has the consumption of primary nutrients failed to increase. This persistency to increase, which economists call a long-term upward trend, is particularly striking in the fertilizer market. C & I will design and construct complete complex fertilizer plants capable of producing any desired tonnage. New economic frontiers do not remain undeveloped for long, and now is the time to consider complex fertilizer as an investment in an industry that has shown phenomenal growth since its inception. Discuss your project with C & I—who can offer you complete marketing, distribution data, and the benefit of their outstanding experience in this particular field. For more information on this new type of plant food, send for the illustrated brochure on Complex Fertilizer."

CI THE CHEMICAL AND INDUSTRIAL CORP.

CINCINNATI 26, OHIO

Designers and Constructors of Plants for the Processing of Ammonia • Available throughout the World

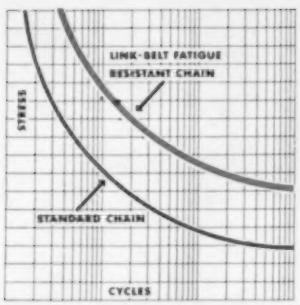
NITRIC ACID • PHOSPHORIC ACID • AMMONIUM NITRATE • AMMONIUM PHOSPHATE • COMPLEX FERTILIZER

LINK-BELT **FR** roller chain

FATIGUE RESISTANT

® U.S. Patent No. 2,517,497

. . . fortified against fatigue

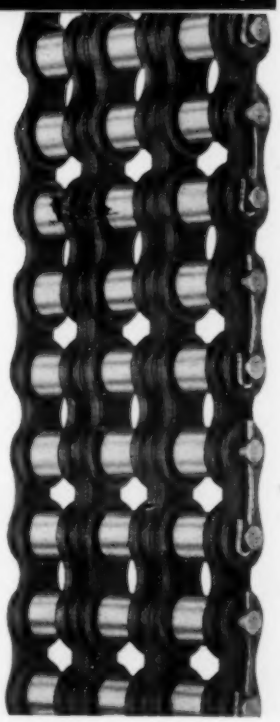


Special sidebar processing lifts chain endurance limit . . . develops greater dynamic strength

The brutal stresses encountered on today's drawworks are too great for ordinary roller chain to long withstand. For this reason, Link-Belt adds FR—special sidebar processing that promotes longer chain life as shown on the above chart. By compressing the metal around pitch holes, Link-Belt fortifies critical sidebar areas against fatigue . . . thus creating extraordinary *dynamic strength*.

Any leading supply store in the field can give you full details and a copy of Link-Belt catalog 2880. You'll also find full information on these Link-Belt roller chain "extras":

- SHOT-PEENED ROLLERS
- PRE-STRESSING
- E-Z ASSEMBLY
- SHEPHERD'S CROOK COTTERS
- CLOSER HEAT-TREAT CONTROL
- DOUBLE BOXING



LINK-BELT

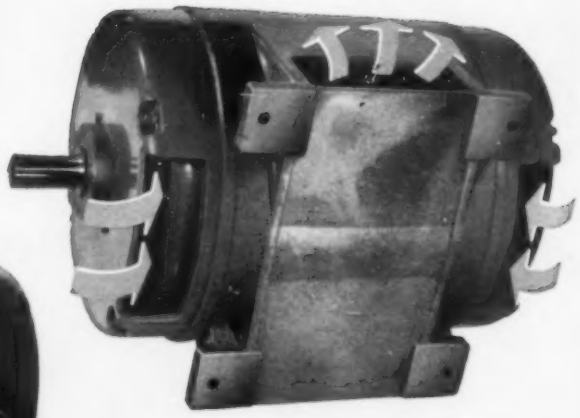
ROLLER CHAINS & SPROCKETS

14,001

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.

WAGNER
POLYPHASE
MOTORS

Type DP
1 to 125 hp.



DOUBLY PROTECTED — Wagner DP Motors offer the *double protection* of completely dripproof enclosures and rugged cast iron frames that can take rough handling and resist corrosion.

These open type motors give DOUBLE PROTECTION... can be used in many places that formerly required splashproof motors

Wagner Type DP Motors offer the *double protection* of rugged corrosion-resistant cast iron frames and dripproof enclosures so well designed that the DP Motor can handle many applications that formerly required splashproof motors.

These Wagner Motors are built in the new NEMA ratings that pack more power into less space, are lighter in weight and are easier to maintain—only occasional lubrication is required.

SLEEVE BEARING MODELS AVAILABLE

The entire line of ratings through 125 hp. is available with steel-backed, babbitt lined sleeve bearings that have high carrying capacity and provide quieter operation.

Let a Wagner Sales Engineer show you how these motors can be applied to your needs. Call the nearest branch office or write for Wagner Bulletin MU-223.

1 to 125 HP—1750 RPM—40°C NEMA FRAMES 182 through 445U

CAN BE RELUBRICATED — These motors can be re-greased when desired for longer bearing life. Fresh grease can be added—old grease removed—through openings provided in the ball bearing housing.

COOL RUNNING — Specially designed baffles direct cooling air through the motor to protect the stator windings. Blowers, cast as part of the rotor, move large volumes of air without noise or vibration.

Wagner Electric Corporation
6389 Plymouth Ave., St. Louis 14, Mo., U.S.A.

WM50-4

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Prove to Yourself

TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS

There is no finer oil well pumping equipment made than TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS. LIBERTY equipment has been proven in field operation since 1918. But the only way *you* can know the performance of this equipment is to *prove it to yourself.*

TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS are available from twenty strategically located field warehouse stocks* to insure prompt delivery to your well site. They are sold through supply stores only.

Descriptive technical literature and price sheets are available on all LIBERTY products. Please contact your LIBERTY Sales Representative or local supply store.

*ARKANSAS: Magnolia; COLORADO: Sterling; KANSAS: Great Bend; LOUISIANA: Shreveport; MISSISSIPPI: Laurel, Natchez; NEBRASKA: Kimball; NEW MEXICO: Farmington; OKLAHOMA: Duncan, Oklahoma City; TEXAS: Abilene, Alice, Albany, Borger, Wichita Falls, Kilgore, Houston, Pampa, Odessa; WYOMING: Casper

TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS

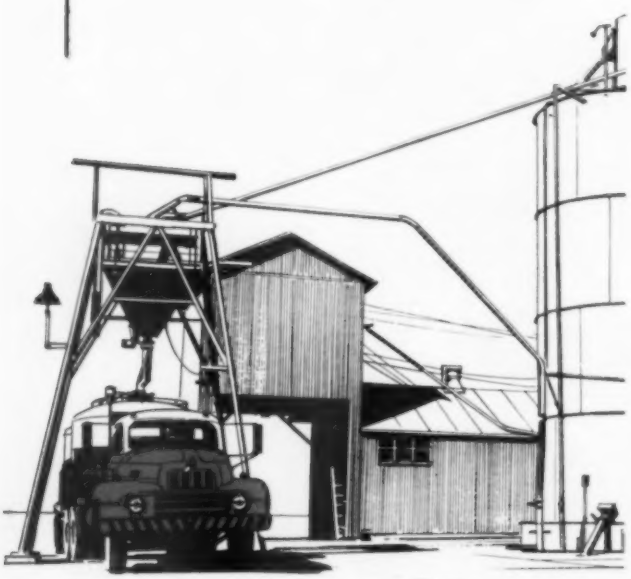
Excellent products of Liberty Craftsmanship and Engineering

LIBERTY

MANUFACTURING COMPANY

4026 Hemphill Street • Fort Worth, Texas

PROGRAMMED CEMENTING FOR PROFIT... by HALLIBURTON



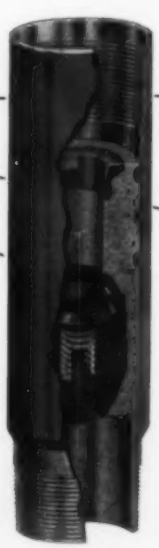
Over the years, well owners everywhere have discovered that cementing requirements can best be served by specifying Halliburton, the cementing organization that gives you a complete cementing program . . . Tailored cement slurries, the best tools and equipment, and cementing specialists with more than a quarter century of experience . . . *more than any other* oil well cementing organization.

For maximum benefits . . . for minimum ordering details through complete programmed cementing . . . call Halliburton first – for *all* your requirements.

THESE PRECISION TOOLS . . . AND MANY OTHERS . . . HELP HALLIBURTON SET THE STANDARD FOR PRIMARY CEMENTING

SUPER-SEAL FLOATING EQUIPMENT:

Get float shoes and collars with more than twice the sealing area of usual ball-and-seat valves. Get positive shut-off against back pressure. Ease strain on rig while running in casing. Halliburton's Super-Seal Floating Equipment sets the standard for the industry.

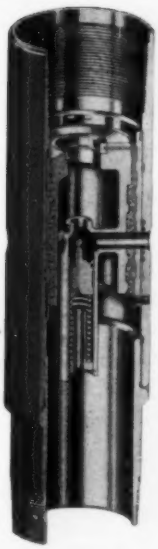


SUPER-SEAL FLOAT COLLAR

AUTOMATIC FILL-UP EQUIPMENT:

AUTOMATIC FILL-UP FLOAT COLLAR

You can reduce running-in time, lessen damaging pressure surges, and revert to the extra advantages of Super-Seal floating equipment at any time with Halliburton's Automatic Fill-up Floating Equipment. These double action collars and shoes have orifices that "meter" the flow of drilling fluids while running casing. The automatic fill-up unit may be tripped, when desired, by a moderate increase in circulating fluid volume, using conventional rig pump.



SELF-FILL DIFFERENTIAL COLLAR

SELF-FILL DIFFERENTIAL COLLAR:

Just one of these tools, placed in the casing string above a Super-Seal Float Shoe or top Float Collar, allows well fluids to fill the casing automatically as it is lowered into the well. It is highly efficient in the deepest drilled wells, even when drilling mud contains a high percentage of cuttings and lost circulation materials. New features help provide an extra margin of safety from the danger of blowout . . . offer greater protection for weak formations . . . afford reduced running-in time for casing . . . and make Halliburton's Self-Fill Differential Collar an exclusive, dependable and versatile automatic fill-up device. The very low differential pressure between annulus and inside of the casing reduces blowout hazard and possibility of formation damage caused by "ram-effect." 80 psi differential is standard; 175 psi is optional, if desired.

CEMENT GUIDE SHOE:

CEMENT GUIDE SHOE

Because the landing of the first joints of casing on bottom to be cemented may be hazardous, it is safer to install a Halliburton Cement Guide Shoe on the first joint. The strong, durable rounded Guide directs the casing away from ledges to help prevent side-wall caving, safely passing hard shoulders, and through crooked holes.

TURBO-JET FLOAT SHOE:

The Halliburton Turbo-Jet Float Shoe is engineered not only to float and guide casing strings to bottom, but also to help agitate and distribute cement to minimize channeling. The built-in rotor forces a powerful jet stream of fluid through side ports and bottom to agitate cement for more uniform cementing around casing giving increased protection. All parts are drillable.

TURBO-JET FLOAT SHOE

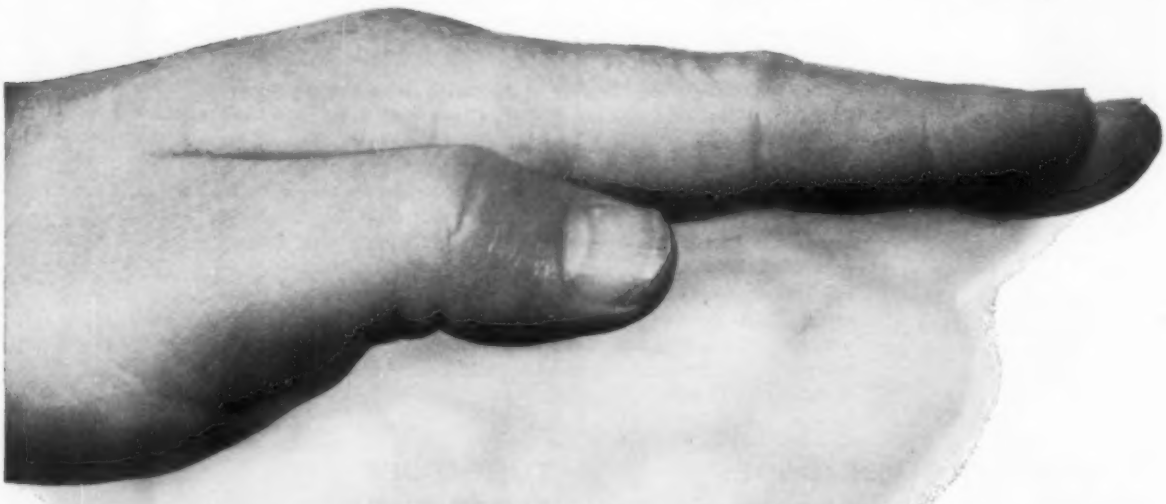
HALLIBURTON
CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

284 SERVICE CENTERS—JUST MINUTES AWAY FROM YOUR WELL

new **S&J** *Breather Valves*

Materially Reduce Storage Tank Vapor Loss



New Shand and Jurs model ST-9749 diaphragm-type breather valves are a major achievement in storage tank venting and vapor conservation. They provide resistance to sticking, corrosion and freezing never before offered. In addition they require practically no maintenance feature non-wetting teflon-on-fiberglas diaphragms for maximum performance and longer life; completely eliminate critical drain holes or other areas that require continuous checking. Ruggedly built from aluminum and stainless steel, ST-9749 breather valves are lightweight, and already available in 4″, 6″, 8″, and 10″ sizes. Call your nearest S&J branch office or sales representative for Technical Bulletin 52D-ST-9749 Breather Valve.

SHAND AND JURS

GENERAL PRECISION EQUIPMENT CORPORATION GPE

2600 Eighth Street, Berkeley, California
Branch offices and representatives in principal cities

To combat chemical and solvent action . . .

Choose a J-M Teflon* Packing!

They're chemically inert . . . available immediately in the J-M Chempac® line

REPORTS from the field are the proof: you just can't beat J-M Teflon packings and gaskets for resistance to the constant attack of chemicals and solvents!

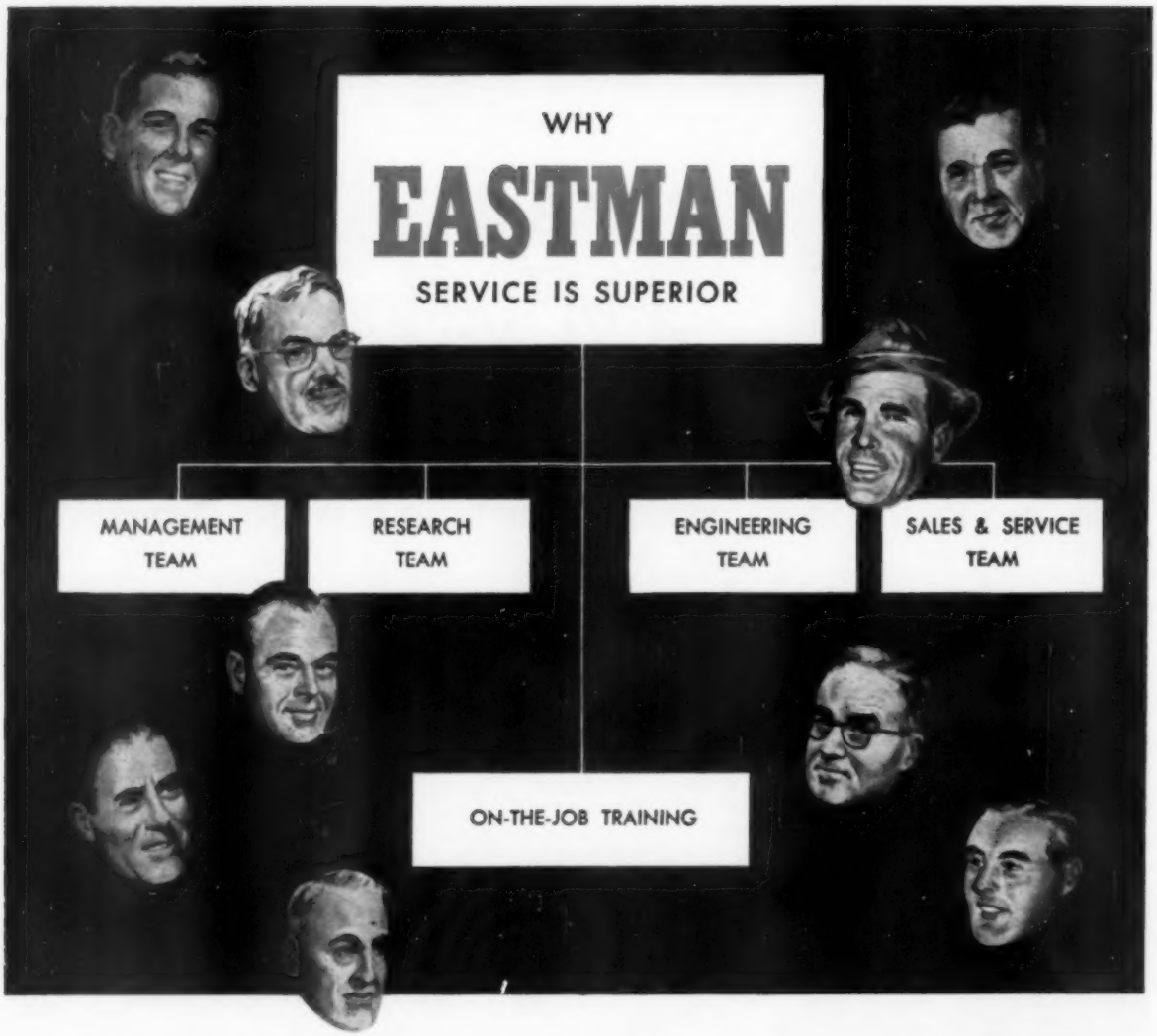
That's why we say . . . you'll find the answer to any corrosion problem in the J-M Chempac line . . . available in pure Teflon, or Teflon combined with asbestos. The latter construction offers the excellent sealing and heat resistance of asbestos, plus the added protection of Teflon against chemical and solvent action.

You'll find Chempac Teflon Packings in moulded and braided types for pumps and valves . . . in a wide range of flange and envelope-type gaskets . . . in rings, cups, sheets and tapes. Moreover, we can tailor-make packings, gaskets and precision-moulded parts to your exact specifications. Important, too, our new Teflon production facilities assure prompt delivery in any quantity you need.

Ask your Johns-Manville Packing Distributor to help you select the right Chempac Teflon Packing for your application—or write Johns-Manville, Box 14, New York 16, N. Y. In Canada, 565 Lakeshore Road East, Port Credit, Ontario. Ask for Brochure PK-124A.

*TM for Dupont Tetrafluorethylene resin

JOHNS-MANVILLE



YEARS OF EXPERIENCE . . . ADVANCED INSTRUMENTS, TOOLS, METHODS, THESE DETERMINE THE DEGREE OF RESULTS AND VALUE FOR MONEY SPENT.

Each time you call on Eastman for service you not only have the advantage of highly skilled individuals but the collective experience and knowledge of a fully rounded out team — encompassing progressive management, research, engineering, sales and service and practical on-the-job training. Over 27 years of world-wide specialized service brings to you the most skilled and efficient performance available in Directional Drilling, Sidetracking and Oil Well Surveying.

Next time, let this Eastman service team demonstrate what an outstanding job it can do for you.

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P. O. BOX 1500 DENVER 1, COLORADO, U.S.A.

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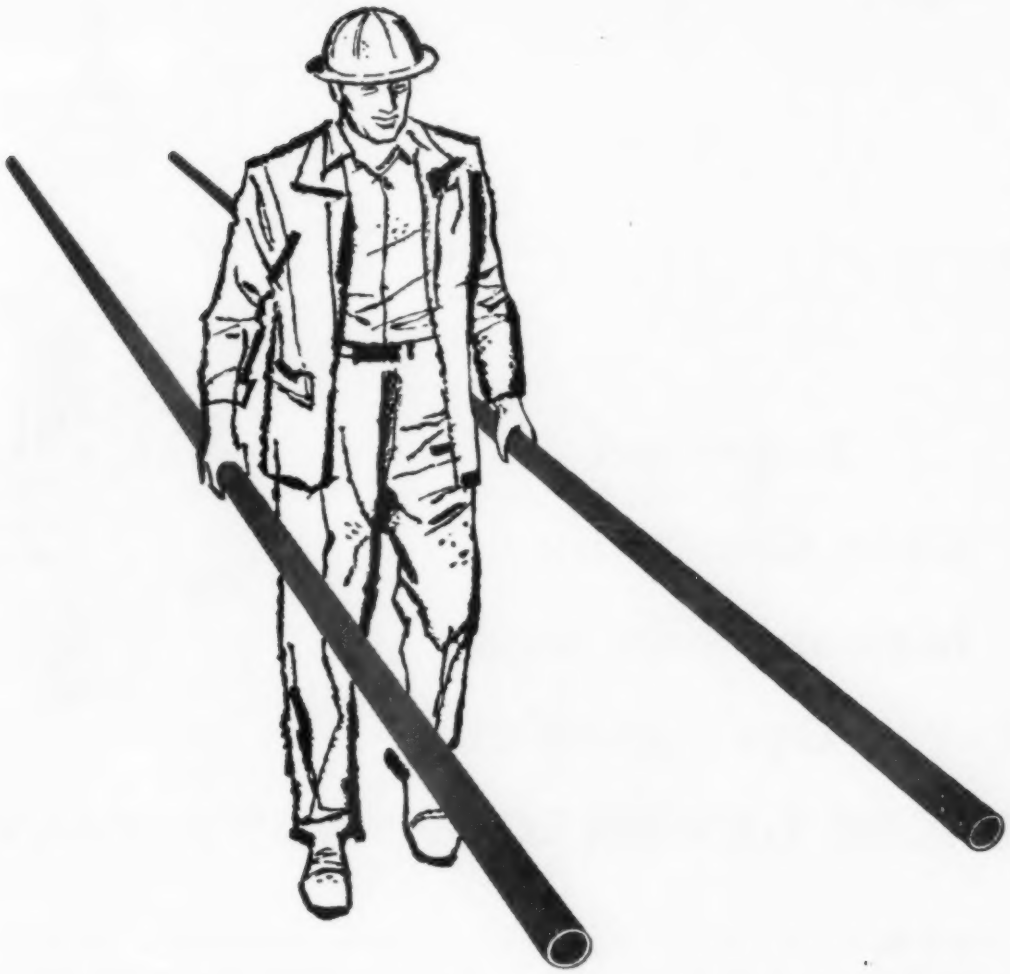


Low installed cost and no maintenance . . . Portable Piping of ALCOA ALUMINUM

Talk about economy! Alcoa's lightweight aluminum pipe means major savings on your piping for water supply, gas lines, gathering systems, tank battery lines and vent lines.

Light weight cuts hauling, handling, installing costs: Because it's so light, you can haul larger quantities of Alcoa® Aluminum Pipe in every truckload. One man can easily handle standard lengths, and that means small crews can lay long lines quickly and easily. The net result is a big cut in installation costs.

Excellent corrosion resistance eliminates heavy maintenance and replacement costs: Severe operating conditions pose no problem for corrosion-resistant aluminum pipe. And it takes the abuse of being laid or strung from supports over rough terrain.

Cut *your* piping costs with portable piping of safe, non-sparking Alcoa Aluminum. It's available—along with quick couplings of aluminum—through a nationwide network of distributors. You'll find them listed under "Pipe" in the Yellow Pages of your telephone directory. Check your nearest distributor for a complete list of sizes available . . . or mail the convenient coupon.

"ALCOA THEATRE"
Exciting Adventure
ALTERNATE MONDAY EVENINGS

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Aluminum Company of America
921-F Alcoa Building, Pittsburgh 19, Pennsylvania

☐ Please send me your new literature describing portable oil country piping of Alcoa Aluminum.

☐ I need low cost, portable piping for the following services:

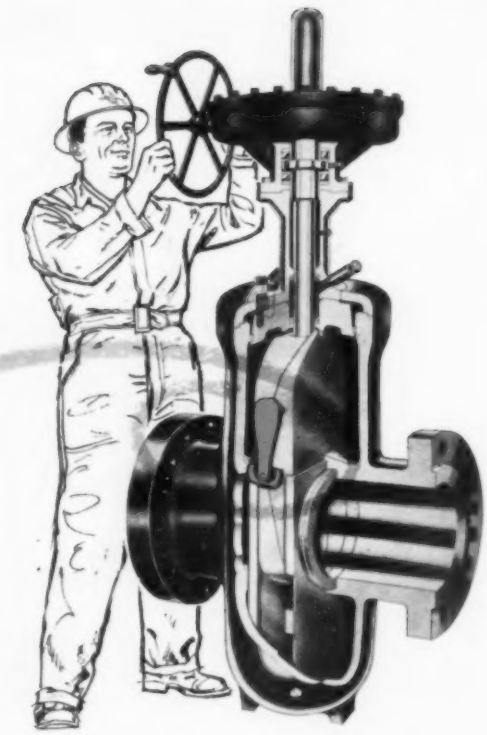
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

W-K-M EXCLUSIVE!



Patented Gate Centralizer Means FREE and EASY Operation of W-K-M LEVERLOCK* GATE VALVES

W-K-M Pipeline Valves open *free* and close *easy*, against any pressure, in any service condition.

An *exclusive* centralizing mechanism—found only in Leverlock Valves—is the reason for this free and easy operation. The patented gate centralizer is a positive-acting mechanical device that holds gate and segment in a collapsed position while closing force is being applied or released. This eliminates any tendency to wedge while the valve is being opened or closed.

Other advantages: Parallel expanding gate gives controlled force seating, upstream and downstream . . . Through-conduit assures full volume, free flow with no turbulence, no pressure drop, free passage of scrapers . . . Renewable seats may be installed while the valve is in the line . . . Pressure seal bonnet seals tighter as pressure increases . . . Superfinished stems mounted on two thrust roller bearings . . . Enclosed packing box and seat lubrication.

*Trademark of ACF Industries, Incorporated
© 1958, ACF Industries, Incorporated

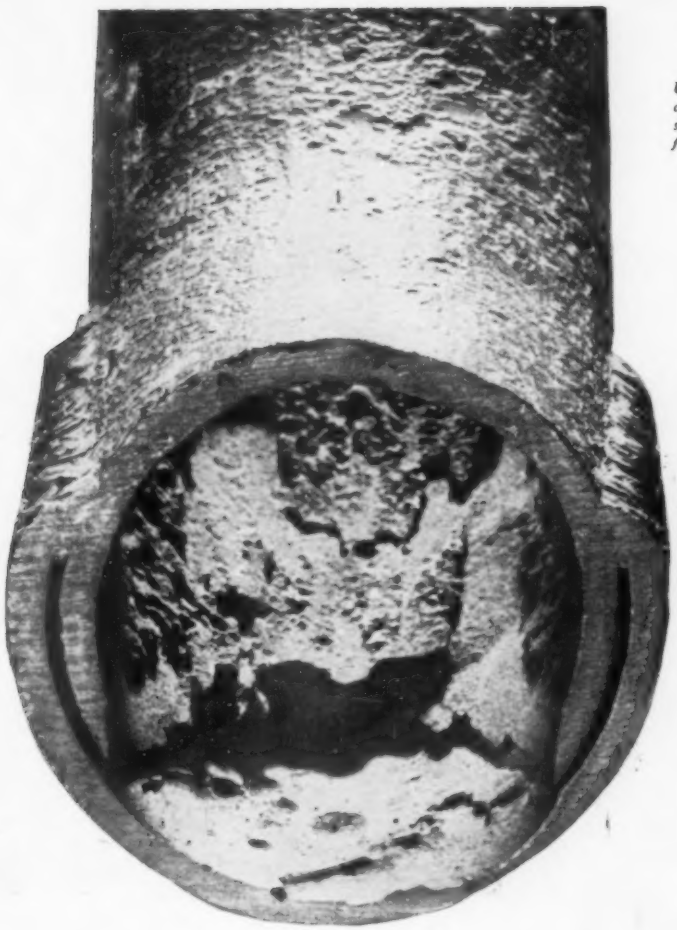
On Hand

Order sizes 2-inch through 12-inch from your supply store. Other sizes up to 34-inch available on special order. (Sizes 6-inch and larger are Leverlock Valves.) Pressures: ASA 300 pounds to ASA 1500 pounds.

W-K-M
DIVISION OF acf INDUSTRIES INCORPORATED
P. O. Box 2117, Houston, Texas

W-K-M's *Creative Engineering* **can assist you with any special problem. If it involves flow of fluids or gases through valves, check first with W-K-M.**

5803



Unretouched photo of pipe, corroded by carbonic acid, which has been "half-soled." This was only a temporary cure, for now the patch is also being eaten away.

WHAT DO YOU PAY FOR "HALF-SOLED" PIPE?

Plenty—in expensive maintenance and costly down time. This pipe has been "half-soled" by welding a metal half-circle over the corroded section—a temporary measure at best. But the original cost has been lost, for now the patch is also being eaten away. You can save money by preventing damage like this with proper water treatment.

A Consulting Service for You. Whatever your water problem—analysis, testing or treatment procedures for boiler water, condensate, cooling towers, process waters—Dearborn has the engineers, the experience and the laboratory facilities to assist you in developing the program exactly suited to your needs. Your Dearborn Engineer will outline the many advantages a Dearborn Consulting Service Program will give you.

WHY NOT CALL HIM IN... **MEANWHILE, MAIL THE COUPON FOR YOUR COPY OF THE DEARBORN CONSULTING SERVICE BOOKLET**

Dearborn®

...a leader in water conditioning and corrosion control since 1887

Dearborn Chemical Company
Dept. OG-WT, Merchandise Mart Plaza, Chicago 54, Ill.

☐ Have a Dearborn Engineer call.
☐ Send booklet on Dearborn Consulting Service.

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Title.....

Company.....

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City.....*Zone*.....*State*.....

Manufacturing plants in CHICAGO • LINDEN • LOS ANGELES • TORONTO • HONOLULU • HAVANA • BUENOS AIRES

"EVERY LENGTH QUADRUPLE-TESTED FOR UTMOST DEPENDABILITY"

Rigid quality control has top priority in production of J&L's Electricweld pipe for gathering, distribution and transmission lines.

Every length is pressure-tested under the specified A.P.I. or A.S.T.M. hydrostatic test requirement both in time and in degree of pressure. Lengths to 60 feet speed installation, reduce number of field welds.

Electricweld pipe is available from 6⅝ inches through 12¾ inches O.D. Electricweld line pipe is manufactured to appropriate A.P.I. and A.S.T.M. specifications.

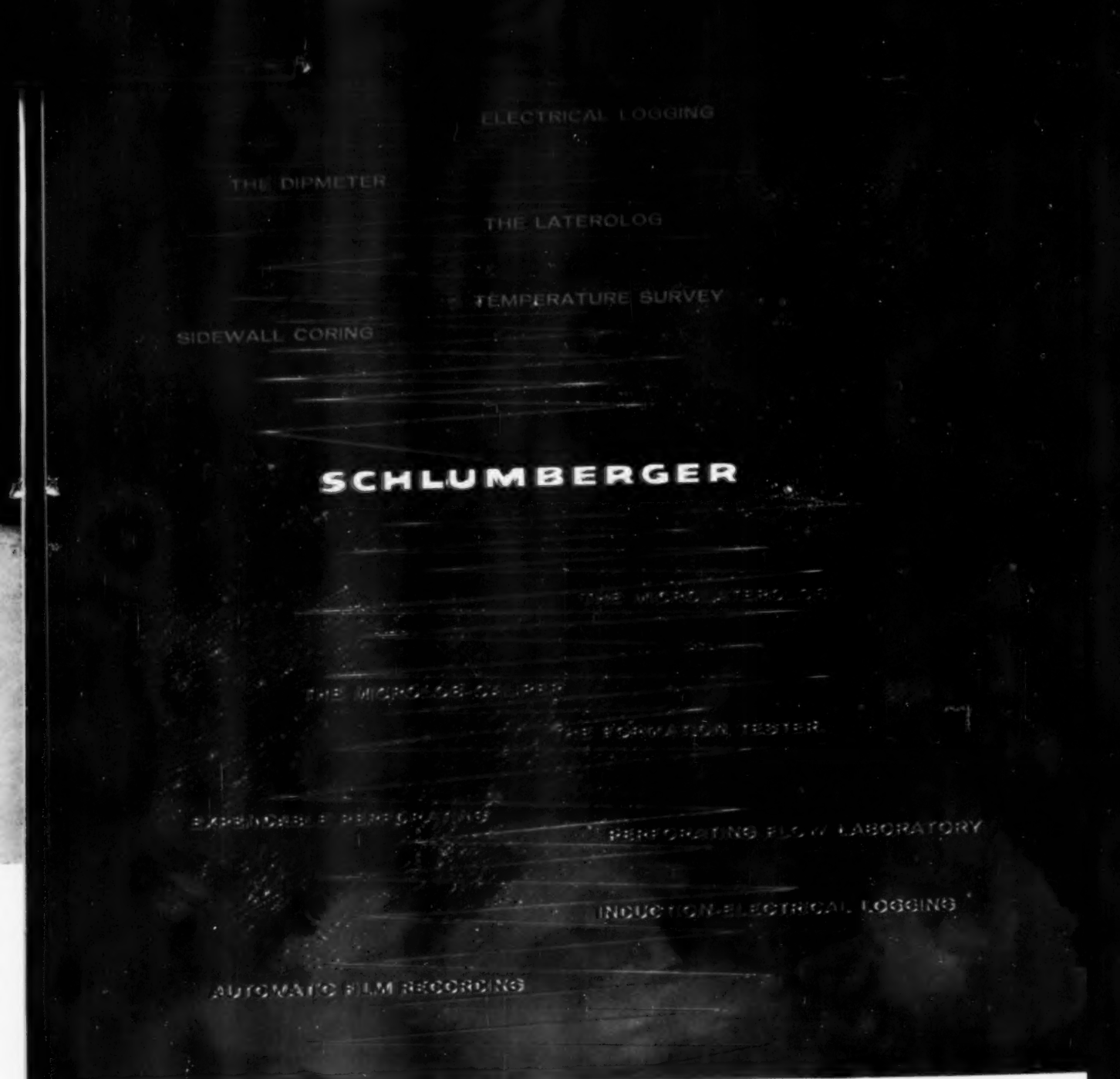
In addition to **visual inspections,** each length of pipe is given a **crush test,** to determine weld strength and quality of steel. It is subjected to a pressure test on one of the largest and most modern **hydrostatic testers** in the world. As an additional precaution and assurance to the customer, Jones & Laughlin is giving both ends of each joint a **magnaflux examination.**

Get complete information on Electricweld line pipe from your J&L distributor or write direct to Jones & Laughlin, 3 Gateway Center, Pittsburgh 30, Pa.

J&L STEEL

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA



imitated, but

never equalled

SCHLUMBERGER

THE EYES OF THE OIL INDUSTRY®

This Tube is Precision Bored to Rifle Barrel Accuracy

Ashcroft Duragauge in Phenol case — a tough, rigid plastic turret type case for wall or flush mounting.

The Bourdon tube in Ashcroft Duragauges is machined mirror-smooth inside and finish ground outside to exact tolerances. Strong, uniformly thick walls assure precise flexibility—sustained high accuracy and long life.

Eight tube materials permit you to select the best metal with sensitivity balanced by internal corrosion resistance. Whether your choice is phosphor bronze, an alloy steel, "K" Monel, a stainless steel or beryllium copper, metallurgical control is exact from ingot to finished tube. Socket and tip joints are welded or brazed, then stress relieved for highest strength and safety. "Whip testing" at pulsating pressures at least 50% greater than rated pressure insures calibration stability.

Order your Ashcroft Duragauges with the best Bourdon tube material for your service. Choose the all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. Full range of pressures, dial sizes, case designs and materials available. In any combination of components, Duragauges give sustained high accuracy and long service. Get details from your industrial supply distributor.

MAXWELL MANNING M&M & MOORE INC. TRADE MARK

ASHCROFT PRESSURE GAUGES

A product of

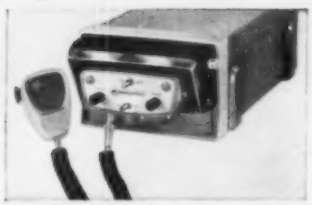
MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

NEW
MOTOROLA
DUAL-SQUELCH
PRIVATE-LINE
2-WAY RADIO...

silences all channel traffic except your own messages



T-POWER

PRIVATE-LINE radiophone is now available in T-POWER (shown above), which features a completely transistorized power supply. Also available as 6/12 volt TWIN-V radio.

Get the complete facts about this startling new type of 2-way radio. Write today for these 2 new folders on PRIVATE-LINE radiophone.

Now, with the new Dual-Squelch PRIVATE-LINE radio, you get all the benefits of improved PRIVATE-LINE operation . . . *plus* easy integration for mixed fleets and monitor-before-transmit.

Because PRIVATE-LINE radio is quiet except when receiving a call from another radio in your own system, you eliminate all the "channel chatter." It's much like having the frequency all to yourself. You benefit by reducing the number of missed or misunderstood messages . . . operator fatigue is reduced . . . overall efficiency is increased.

Dual-Squelch PRIVATE-LINE radio gives you these basic features . . . and more. Now you can make a gradual changeover to PRIVATE-LINE operation. During the transition period, your messages can be received by both Motorola conventional and PRIVATE-LINE radios. No longer is it necessary to make the complete changeover to PRIVATE-LINE operation at the same time. And with the new Dual-Squelch operation, you can have manual selection or optional automatic monitoring of the channel before transmitting.

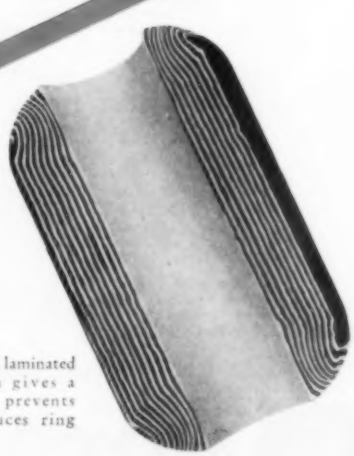
Before you select your 2-way radio, you'll want to investigate Motorola Dual-Squelch PRIVATE-LINE radio.

MOTOROLA PRIVATE-LINE RADIOPHONE

MOTOROLA Communications & Electronics, Inc., A Subsidiary of Motorola, Inc., 4501 Augusta Boulevard, Chicago 51, Illinois

are used again and again!

The laminated construction of Tube-Tectors® means tighter grip on the drill pipe. It also means more resiliency, more economy in use. Tube-Tectors can be moved from one string of pipe to another with perfect confidence even after three or more moves. But despite the unique design and manufacture features, and the economy of extended re-use, Tube-Tectors cost no more than ordinary protectors. Here's another good way to cut drilling costs—from Tuboscope. Call a Tuboscope engineer now.

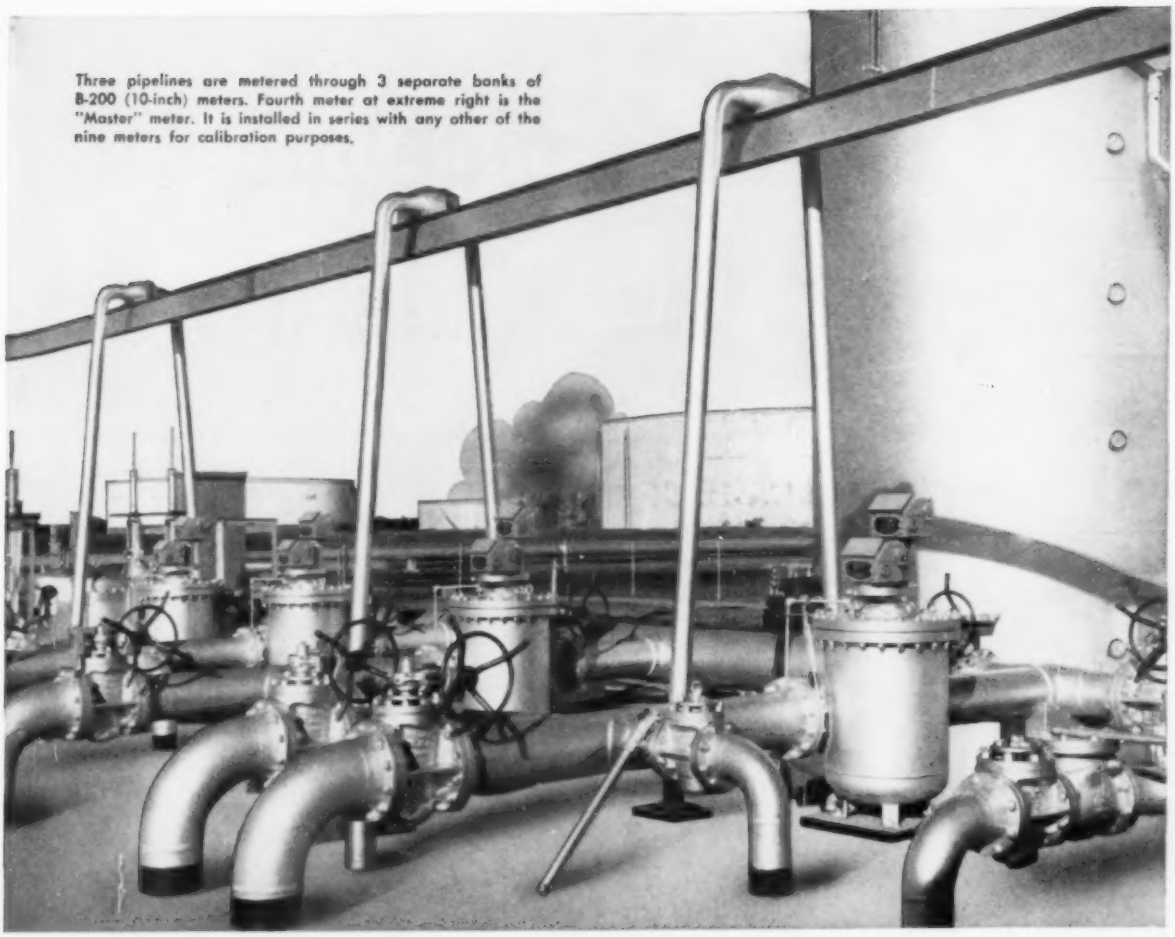


The design and laminated construction gives a tighter grip, prevents slippage, reduces ring corrosion.

Tuboscope COMPANY

2919 Holmes Road
HOUSTON, TEXAS

Tuboscope drill pipe-casing protectors and pipe inspection services are available in oil fields throughout the United States and Canada. For export: write Tuboscope.



Three pipelines are metered through 3 separate banks of 8-200 (10-inch) meters. Fourth meter at extreme right is the "Master" meter. It is installed in series with any other of the nine meters for calibration purposes.

three A. O. Smith meter banks effect savings by

Cutting Breathing Loss!

for major crude pipeline located in the Gulf South

This installation of A. O. Smith pipeline meters reduces breathing losses by eliminating tankage used for measurement purposes. Crude runs are dispatched directly to the refinery.

Daily throughput of all ten meters totals approximately 275,000 barrels.

For complete details on how you can get similar savings, cut equipment dollars and space needs, contact your representative or write direct.

Through research A.O. Smith *... a better way*

A.O.Smith

CORPORATION

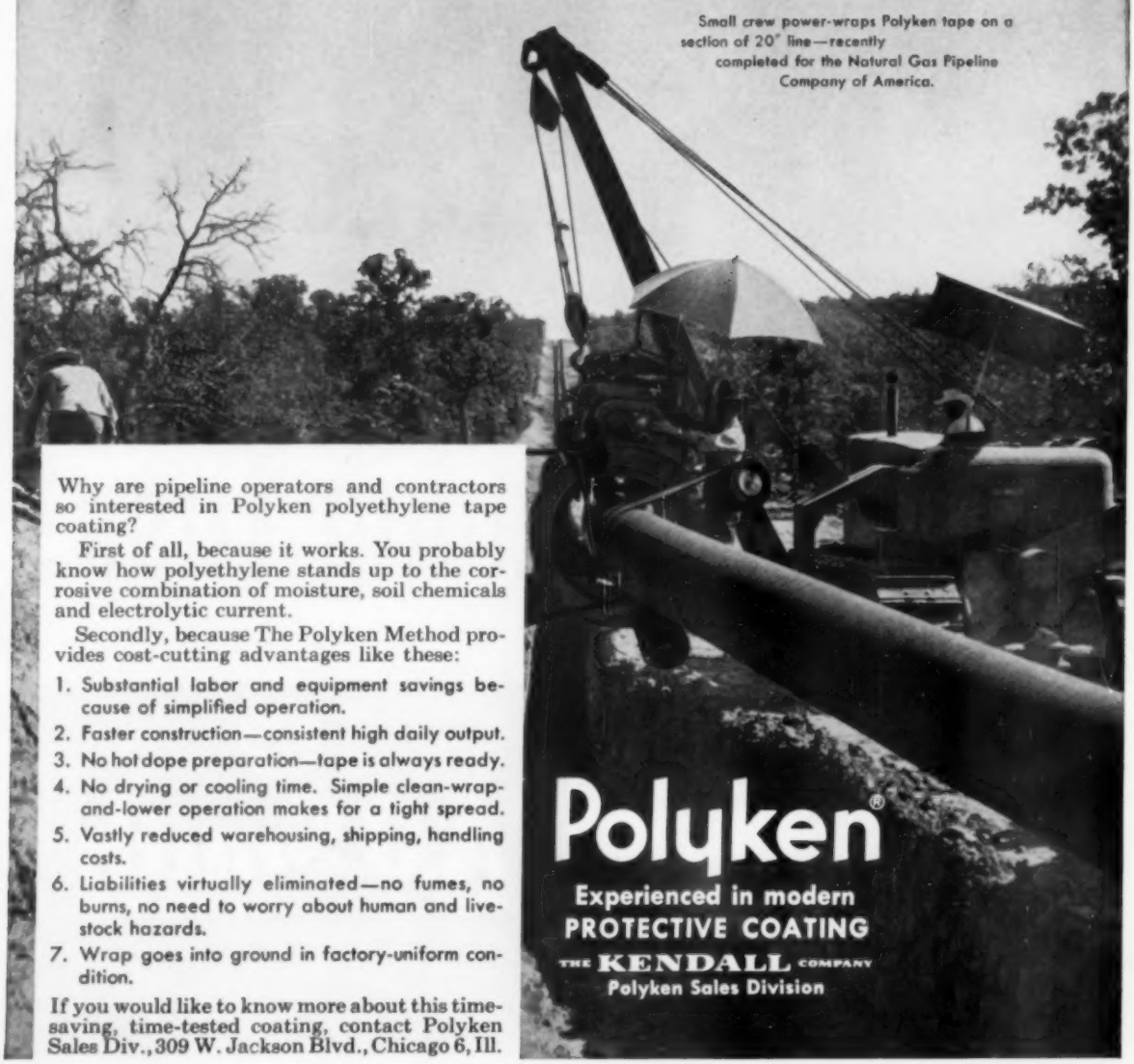
METER, SERVICE STATION PUMP, DIVISIONS

Factories: 5715 Smithway St., Los Angeles 22, Calif.; P. O. Box 500, Succasunna, N. J. Offices: Atlanta 5, Ga.; Chicago 4, Ill.; Houston 2, Texas; Los Angeles 22, Calif.; New York 17, N. Y. Canada: Toronto 12, Vancouver 1.

A. O. Smith International S. A. Milwaukee 1, Wisconsin, U. S. A.

Big-Inch pipeline wrapped the modern way

Polyken Tape saves time, labor and handling costs, yet resists corrosive attack as only polyethylene can



Small crew power-wraps Polyken tape on a section of 20" line—recently completed for the Natural Gas Pipeline Company of America.

Why are pipeline operators and contractors so interested in Polyken polyethylene tape coating?

First of all, because it works. You probably know how polyethylene stands up to the corrosive combination of moisture, soil chemicals and electrolytic current.

Secondly, because The Polyken Method provides cost-cutting advantages like these:

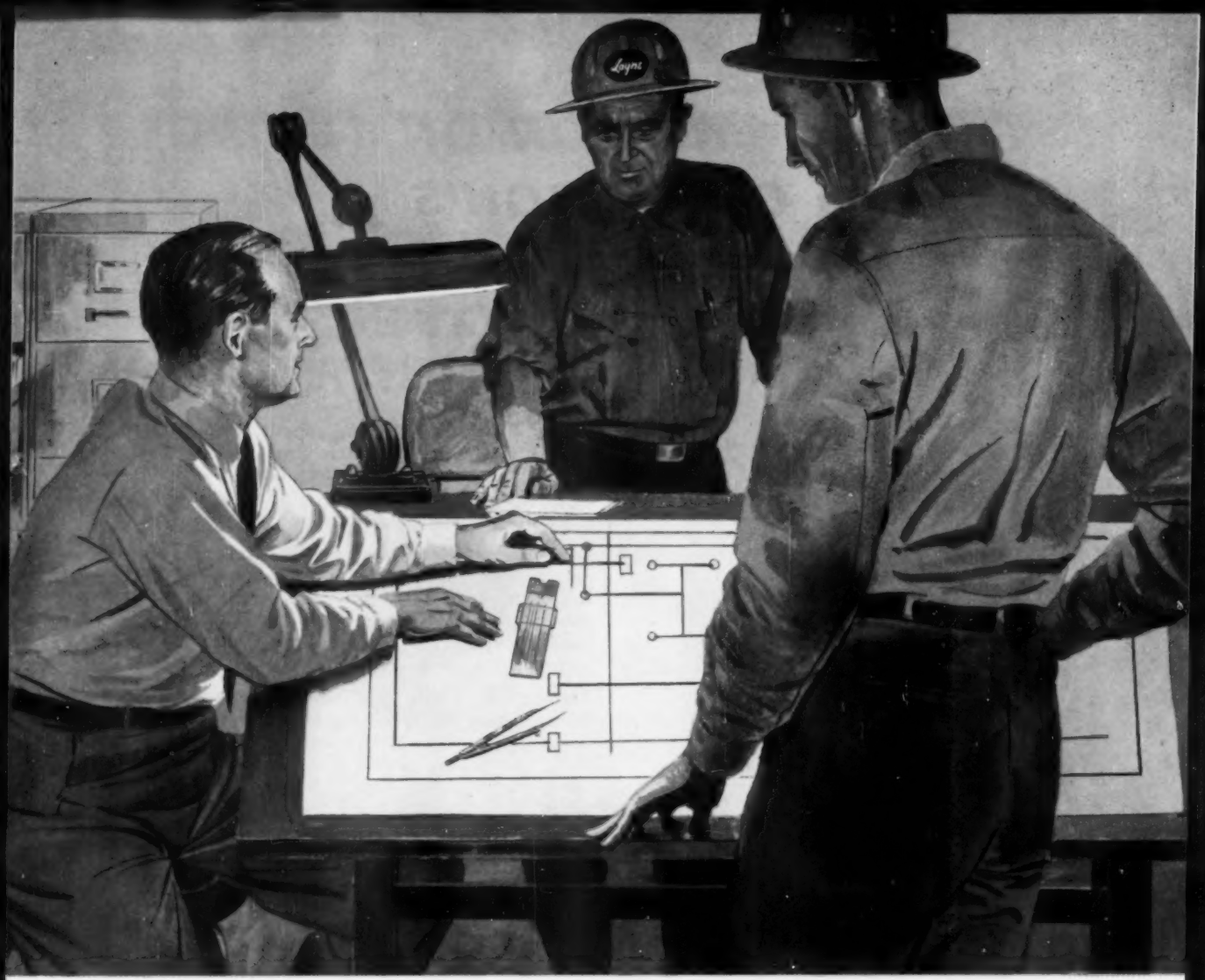
1. Substantial labor and equipment savings because of simplified operation.
2. Faster construction—consistent high daily output.
3. No hot dope preparation—tape is always ready.
4. No drying or cooling time. Simple clean-wrap-and-lower operation makes for a tight spread.
5. Vastly reduced warehousing, shipping, handling costs.
6. Liabilities virtually eliminated—no fumes, no burns, no need to worry about human and livestock hazards.
7. Wrap goes into ground in factory-uniform condition.

If you would like to know more about this time-saving, time-tested coating, contact Polyken Sales Div., 309 W. Jackson Blvd., Chicago 6, Ill.

Polyken®

Experienced in modern PROTECTIVE COATING

THE KENDALL COMPANY
Polyken Sales Division



Water plans – include LAYNE

No two petroleum operations can be alike. Since heat load removal and process consumption vary, so must the design of the water system supplying the need. Providing for normal operational needs plus a safety margin for peak operations is a job for water specialists.

Layne offers complete water system service, from initial geological studies thru well drilling and pump installation to service and maintenance.

A complete staff of hydrologists, engineers, consultants, technicians and field crews are available for any phase of water system planning, installing and servicing. Layne services do not replace but coordinate with the services of consulting, plant or city engineers.

LAYNE & BOWLER, INC., MEMPHIS
GENERAL OFFICES AND FACTORY • MEMPHIS 8, TENN.
LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

Layne

Water Wells • Vertical Turbine Pumps • Water Treatment

TO: LAYNE & BOWLER, INC.
MEMPHIS 8, TENN.

Gentlemen: Please send me bulletin No. 100.

Name _____

Title _____

Organization _____

_____

Address _____

City _____

State _____

STOP JET EROSION ON TUBING
with GUIBERSON'S

TUBING PROTECTOR RUBBERS

Protect that joint of tubing opposite casing perforations from jet stream impingement with Guiberson rubbers. Tough and resilient, they absorb the jet stream energy that erodes away steel tubing.

Compression molded from a special compound developed in Guiberson's Rubber Laboratory, these extra-dense rubbers have highest resistance to live oil and gas.. excessive bottom hole temperatures. At the same time, they eliminate cutting and abrasion by sand.

Self-aligning, interlocking design completely covers tubing and speeds up installation (no exposed gaps). We field install them at no extra cost to stay put on 2" or 2½" tubing. They snap into place under light tension.

Independent laboratory tests, made under the severest sand and live oil jetting conditions, show Guiberson tubing protector rubbers out-perform and far outlast other coatings.. such as lead, plastics and hard metal. Guiberson tubing protector rubbers not only save tubing, but may save a pulling job.

INTERLOCKING TYPE

OVERLAPPING TYPE

Guiberson's overlapping type tubing protector rubbers are available in 2" and 2½" tubing sizes. The 2" size is designed to pass through Guiberson drillable packers.

THE GUIBERSON CORPORATION

ESTABLISHED 1919

DALLAS, TEXAS U. S. A.

Always the Best

THE PARKERSBURG RIG & REEL COMPANY

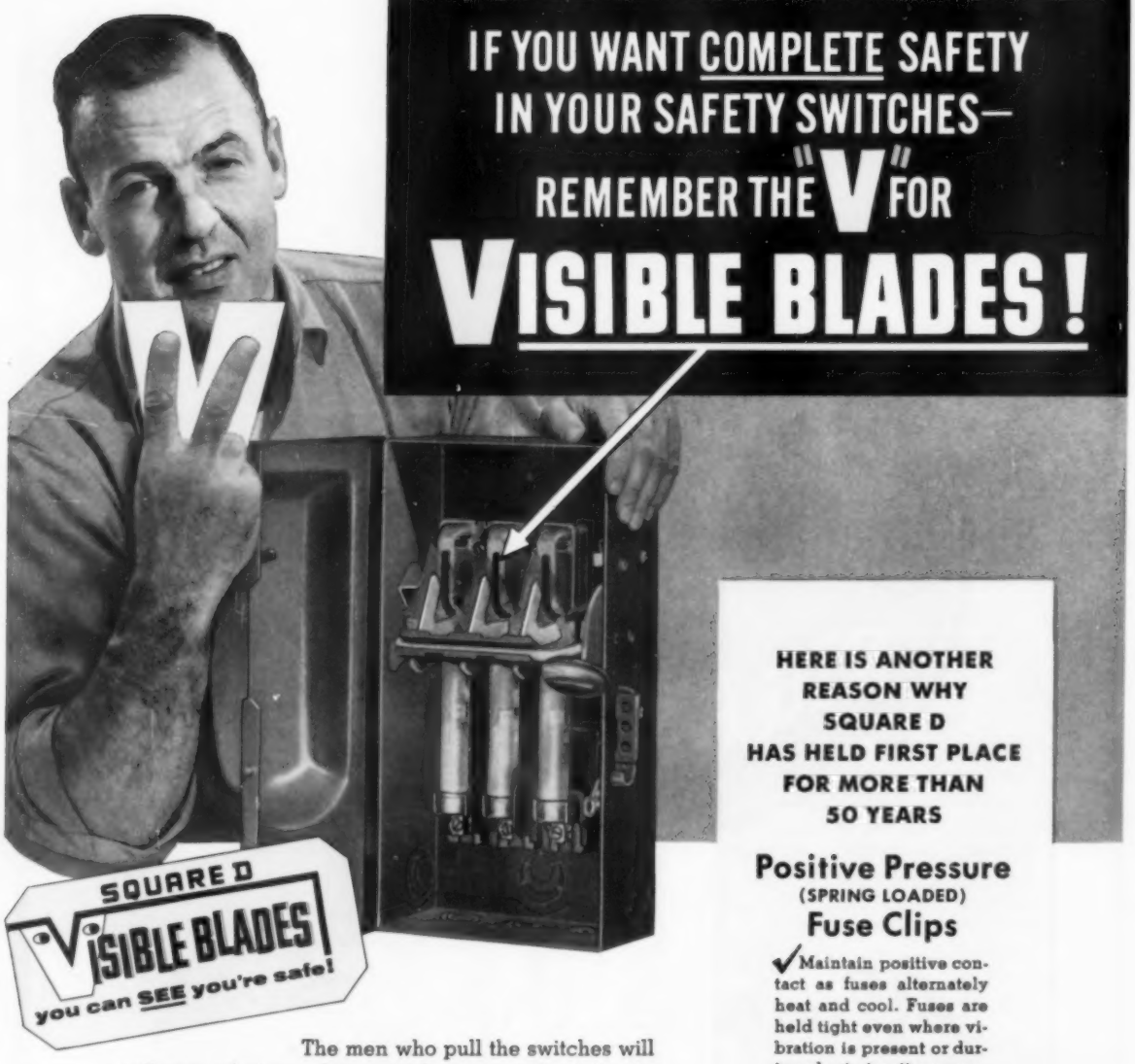
Division of Parkersburg-Aetna Corp.

Drilling and Specialties Division Offices:
P. O. Box 1160
Parkersburg, West Virginia

Production Equipment Division Offices:
P. O. Box 13295
Houston 19, Texas

Pumping Unit Division Offices:
710 Mid-Continent Building
Tulsa, Oklahoma

IF YOU WANT COMPLETE SAFETY IN YOUR SAFETY SWITCHES— REMEMBER THE "V" FOR VISIBLE BLADES!



HERE IS ANOTHER REASON WHY SQUARE D HAS HELD FIRST PLACE FOR MORE THAN 50 YEARS

Positive Pressure (SPRING LOADED) Fuse Clips

✓ Maintain positive contact as fuses alternately heat and cool. Fuses are held tight even where vibration is present or during short circuit surges.

✓ Fuse clip jaws use pure copper for current-carrying parts and spring steel for pressure. They reduce heating 80% over commercial type clip.

✓ No clamps or screws to tighten—or to forget to tighten.

The men who pull the switches will tell you what can happen when a switch, *believed* to be open—*isn't.* A lot of things can happen—and every one of them is bad. Personnel safety is in jeopardy. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

Doesn't it make sense to insist on **V**isible Blade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages?

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

run it right . . . with quality engineered

BAASH-ROSS
Tubing and Hinged Casing Spiders

HINGED CASING SPIDER

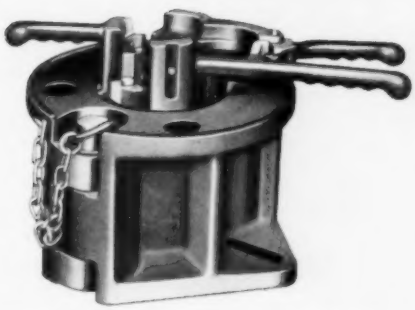
You can run the heaviest or lightest weight casing and tubing with Baash-Ross Spiders and Slips with no danger of crimping the pipe or losing the string when the slips are in place.

Made of high grade steel, Baash-Ross Spiders and Slips are available in sizes and types to meet every drilling and production requirement. Slips are unitized so that all surfaces grip the pipe evenly and firmly. The steep taper backs allow easy release.

- Hinged Casing Spiders have a working capacity of 200 tons with a 3 to 1 safety factor and openings to handle up to 20" casing.

- Type "TS 100" Tubing Spiders are adaptable to running single, double or triple tubing strings. An automatic, positive latch guards against accidental opening of slips for perfect safety, even while running multiple strings.

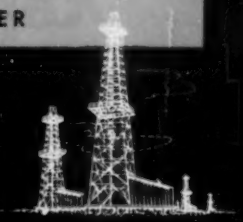
- Baash-Ross Open End Spiders are rated at 100 ton capacity to run the longest tubing strings with complete safety. These spiders are engineered to handle the newest type high alloy deep well pipe available. 10" long slips hold firmly with no danger of collapsing the pipe.



"TS 100" TUBING SPIDER

OPEN END TUBING SPIDER

Protect your next well with proven Baash-Ross Spiders and Slips. Be sure your file contains complete information on all Baash-Ross equipment. For additional details, see the Composite Catalog or write Dept. D-616, P. O. Box 1348, Houston 1, Texas.



BAASH-ROSS DIVISION
OF JOY MANUFACTURING COMPANY

BAASH ROSS JOY

GENERAL OFFICES: 5306 CLINTON DR., HOUSTON, TEXAS

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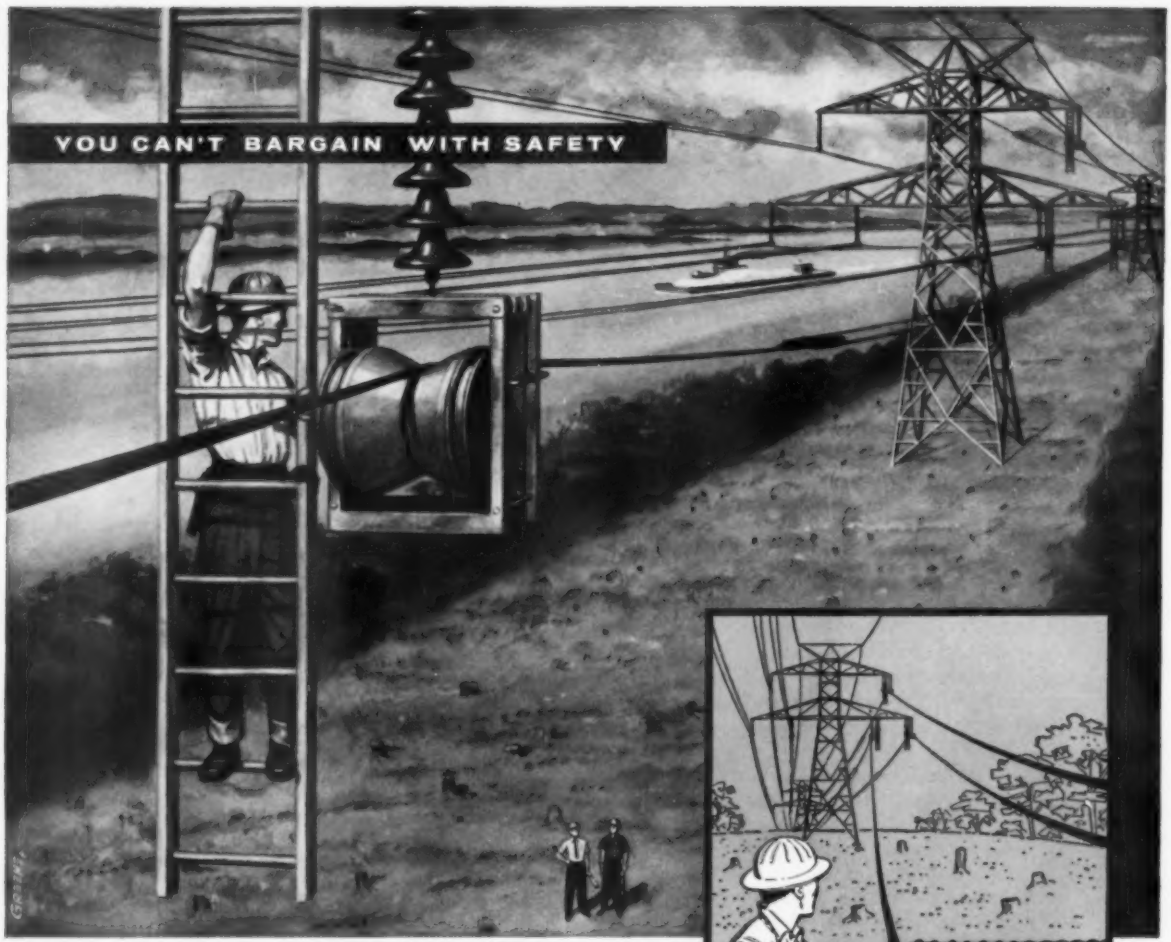

Stringing conductors on towers carrying a live 330,000 volt circuit is a tough job. Hoosier Engineering Company of Columbus, Ohio, does it by threading conductors up to 1¾" through a tension machine and pulling them over sheaves on the tower arms with 9000 foot lengths of Wickwire Wire Rope. On jobs like this, where men's lives are at stake . . .

rope failure can be fatal

Whether you're stringing power lines, pulling drill pipe, or handling other hazardous hoisting jobs—don't bargain with safety. "Bargain" wire rope can cause more trouble and expense than you expect. Buy wire rope on the basis of *quality* . . . buy Wickwire Rope.

For extra strength—buy Wickwire's Double Gray IWRC extra improved plow steel wire rope

WICKWIRE ROPE — A CF&I PRODUCT

CF&I

LOOK FOR THE YELLOW *TRIANGLE*

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

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5924

In France . . . and in 4 Corners . . .
General uses FAILING CFD-1 RIGS

GENERAL GEOPHYSICAL COMPANY

TELEPHONE CAPITOL 2-6325

750 HOUSTON CLUB BUILDING

HOUSTON 2, TEXAS

March 31, 1958

George E. Failing Company
Enid, Oklahoma

Gentlemen:

Our Party No. 1, General Geophysical Company de France, using two Failing CFD-1 drills, has just completed 12 months of continuous shot hole drilling -- with only one day total down-time. Considering the number of feet drilled, and the formations encountered, we feel this is an impressive drilling record.

Operating in Southern, Central and Western France, for the Compagnie d'Exploration Petroliere, (Paris), party chief C. A. Dittrich, party manager W. H. Sheehan and their crew completed 260,000 feet -- nearly 50 miles -- of shot holes under every conceivable field condition. They drilled through formations ranging from marls to hard limestones, from clays to granite boulders and conglomerates. Surface conditions varied from the easiest to the most difficult -- wet marsh, firm topsoil, loose sand, bare limestone. Yet, their two Failing CFD-1 drills gave top performance day after day.

This drilling record proves again that experienced personnel and good equipment make an unbeatable combination. While we feel that the performance of these CFD-1 units are a great credit to the Failing Company, we know that the outstanding efforts on the part of our key personnel made this record possible.

Incidentally, the Failing CFD-1 which we are using in our Four Corners Area operations is also giving excellent production results.

Very truly yours,

GENERAL GEOPHYSICAL COMPANY

By: T. O. Hall
T. O. Hall
President

T. O. H. /jb

THE FAILING CFD-1 Combination rig is equipped for drilling with either air or water. It is fast, versatile, and extremely rugged. Its hydraulic drive maintains a constant bit pressure, gives a smooth feed, and prevents overstressing or breaking the feed chains.

Shown here in Western France, this FAILING CFD-1 Combination rig gave top performance day after day under adverse field conditions.

Party No. 1, General Geophysical Company de France (Left to Right) Charles A. Dittrich, party chief; Bert Arnold, driller; W. H. "Blue" Sheehan, observer and party manager; Leroy Ledbetter, chief driller.

FAILING CFD-1 Combination rig operating in Four Corners area. Rig is owned by General Geophysical Company. In the picture: Lee Sturgeon, driller; Robert Hutchings and M. L. Novakoski.

FAILING RANKED FIRST in domestic deliveries of shot hole and water well rotary drilling rigs in 1957.

GEORGE E. FAILING COMPANY ®

GEORGE E. Failing® COMPANY

A SUBSIDIARY OF
WESTINGHOUSE AIR BRAKE COMPANY
ENID, OKLAHOMA, U.S.A.

How gleaming aluminum buildings rise from red mud

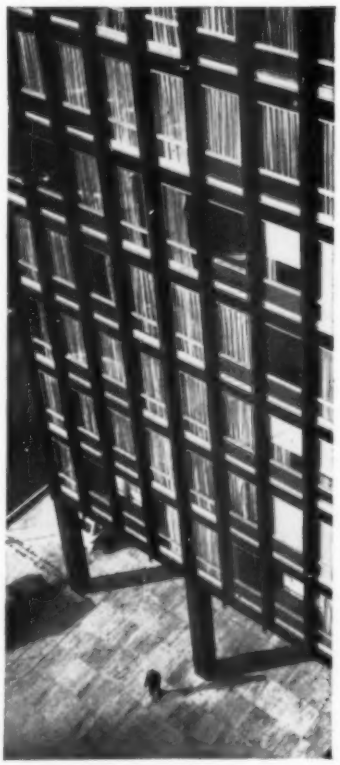
From Babel onward, men have held the vision of ever brighter, ever lighter towers soaring to the sky. Modern metals provided practical substance for the old dreams . . . look around at what's come true so recently.

High on any list of today's versatile, economical building materials you find aluminum and its alloys. Plate, sheet, rolled forms, extruded sections, tubing, wire, rod—forged, stamped, spun—this wondrous metal answers architects' aspirations, fabricators' requirements and users' needs.

With aluminum, as is so often true, the basic raw material is found in nature wildly mixed with other mineral compounds. Bauxite must be carefully purified to provide alumina, the effective starting point for aluminum. Here again, we're happy to report, major producers turn to Columbia-Southern.

Finely ground bauxite is digested with an alkaline solution, under pressure and heat. Treatment with the alkali separates bauxite into sodium aluminate (just several short steps this side of alumina) and a sludge of impurities called "red mud." No other chemical product known effects this necessary and delicate process so well, so economically as soda ash.

Columbia-Southern supplies soda ash to hundreds of producers of non-aluminum goods, too. A personal talk, call or wire can bring tank cars of chlorine, soda ash or other basic alkalies and specialty products to your siding with a speed that will probably amaze your own Traffic Department. Why not contact Columbia-Southern today, while the thought's still fresh?



900 Esplanade Apartments, Chicago—a new concept in multi-story exteriors making extensive use of aluminum supplied by Reynolds Metals Company.
Architect: Ludwig Mies van der Rohe

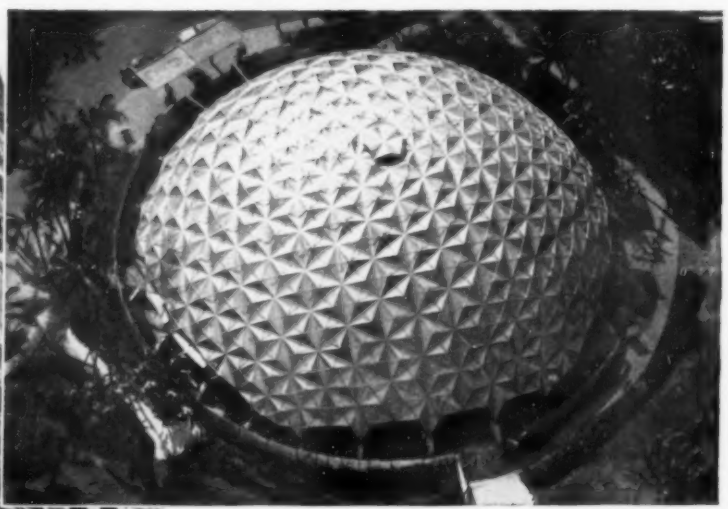
COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

chemicals at work

CHLORINE, ALKALIES AND RELATED CHEMICALS
OFFICES IN PRINCIPAL CITIES
IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

The Alcoa Building, world's first aluminum skyscraper, headquarters of the Aluminum Company of America, Pittsburgh, Pennsylvania. Architects: Harrison & Abramowitz.

Aluminum-domed auditorium, first structure of its kind to be built, graces the Hawaiian Village Hotel in Honolulu. Designed by Kaiser Aluminum & Chemical Corporation.



NOW! AN ALL-NEW

Forged Steel Gate Valve

by LUNKENHEIMER

Another addition to the world famous line. In design, materials, and workmanship, this new Forged Steel Valve offers traditional Lunkenheimer performance to cut your maintenance costs to rock bottom. It's compact to fit cramped installation areas, without excess weight—yet safely handles high pressures and temperatures. Discs are 500 Brinell 13 Chrome Stainless Steel. Precision machined guides keep the disc from dragging across seat rings. Hardened 13 Chrome Stainless seat rings are rolled-in—never loosen in service. A two-piece gland of ball-and-socket design prevents binding in stuffing box.

See your Lunkenheimer Distributor, or write The Lunkenheimer Company, Cincinnati 14, Ohio, for literature.

LUNKENHEIMER QUALITY

Fig. 8001

OUTSIDE SCREW AND YOKE—BOLTED BONNET

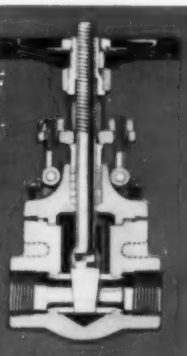
800 lbs. 850 F—2000 lbs. 100 F
Fig. 8001—Screw Ends, Sizes ½"—2"
Fig. 8002—Socket Welding, Sizes ½"—2".

KEYED HANDWHEEL

A strong torque transmitting connection to yoke bushing is provided by a handwheel key. All parts easily dismantled and reassembled. Handwheel nut securely locked in place.

UNIFORM SEAT-DISC HARDNESS

Discs are 500 Brinell—not just on wearing surfaces but all the way through. Uniform hardness eliminates danger of chipping or cracking in service. Seat Rings are also hardened.



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from men who produce organic chemicals...

a new standard for technical assistance

Who is better qualified to give you practical technical assistance on organic chemical problems than the men responsible for the daily operation of a modern organic chemicals plant?

To give you the kind of service you need, operating and design engineers, process control chemists and material handling specialists from our Doe Run Plant are available now to assist your production men with problems common to organic chemicals.

Our experience in producing organics can go a long way in helping you in using these chemicals. For information call or write today.

Ethylene Oxide, Ethylene Glycol, Ethylene Diamine, Diethylene Glycol, Triethylene Glycol, Polyethylene Glycols (Poly-G's), Polyamines, Ethanolamines, Dichloroethylether, Ethylene Dichloride, Surfactants (Poly-Tergents), Glycol Ether Solvents (Poly-Solv's)

Poly-G, Poly-Solv and Poly-Tergent are registered trademarks

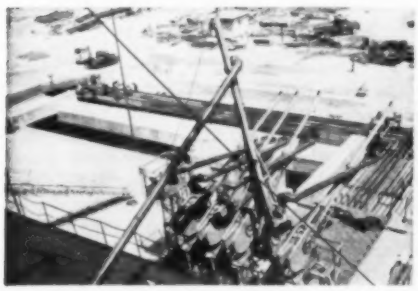
OLIN MATHIESON CHEMICAL CORPORATION

ORGANIC CHEMICALS DIVISION

OLIN MATHIESON CHEMICAL CORPORATION
ONE PARK AVENUE, NEW YORK 16, NEW YORK

6043

RICHFIELD INSTALLS NUMBER FOUR



Where once seven men labored 30 minutes to hook up rubber hose, now one man operating hydraulic controls swings a Chiksan Loading Arm aboard, ready for hook up, in less than a minute. There are 96 Chiksan Marine Loading Arms in service throughout the world. Many more are on order.

Richfield, like other users who are reordering, has installed still another bank of Chiksan Marine Loading Arms.

The first bank of Chiksan Marine Loading Arms on the West Coast went into service at Richfield's Terminal No. 2 in May, 1956. Subsequently, two additional banks of five were installed to render the facility among the most modern anywhere. This terminal has since handled over 50 million barrels of crude and refined products of many grades. Now, with growing need for greater transfer capacity, Richfield has ordered and installed an additional bank of three arms.

On every count, Safety, Economy, Speed, the Chiksan Marine Loading Arm measures up. So substantial are the savings gained from faster loading, greatly reduced replacement costs, fewer loss-time injuries, and elimination of rupture potential, that in many cases these savings can easily amount to the actual purchase price within three years.

Send for informative bulletin and payout analysis today.

fmc

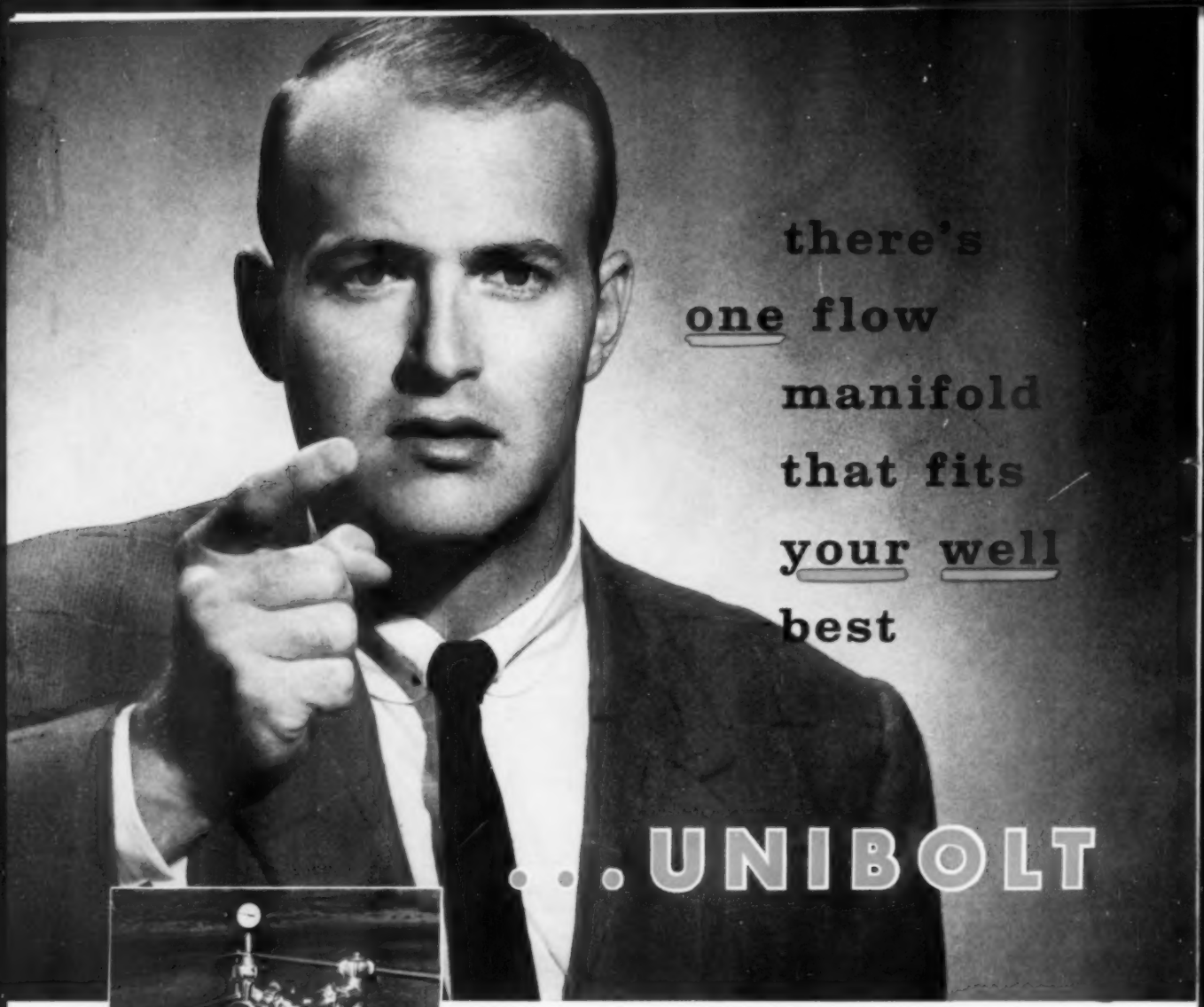
A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

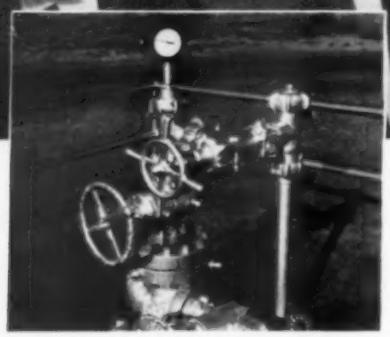
CHIKSAN

CHIKSAN COMPANY—BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

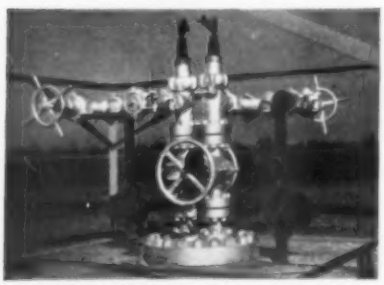
Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada, Ltd.

#58-33





UNIBOLT Flow Manifolds are available in Tee or Cross Type, 6,000, 10,000, and 15,000 lbs. test.



UNIBOLT Flow Manifolds on a dual parallel string completion.

UNIBOLT Flow Manifolds (unlike flow controls of fixed design) permit any desired arrangement of wing valves and chokes. They may be assembled and tested at the factory to meet your exact requirements. Then, when the well goes on the pump and the Flow Manifold has served its purpose, it may be salvaged as a complete unit for use on another well, or it may be dismantled and its separate units used wherever needed. Its component parts —tee or cross, wing valve, and choke body—interchange with all other UNIBOLT products of the same size.

Remember, too, that a UNIBOLT tee or cross provides a safe, easy connection for a lubricator equipped with the mating half of a UNIBOLT coupling.

If it is your responsibility to specify Christmas tree manifolds, you'll be interested in our "24 reasons why Unibolt Flow Manifolds are better." Let us send you a copy. Write to:

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

● You can add extra "sales building" qualities to even the best refined fuel oils, with SANTOLENE H-LV, Monsanto's new fuel stabilizer.

● With a low concentration, you can cut down sedimentation, virtually eliminate screen-clogging sludge, AND provide the highest rust protection for home heating oils, Diesel fuels, and industrial fuel oils. SANTOLENE H-LV imparts a high degree of rust protection at concentrations equal or below the level at which less potent fuel additives provide a degree of stabilization *only*.

(Test this for yourself with ASTM D665-50T, modified to run 48 hrs. @ 80° F.)

Fuel oil marketing departments can use the extra qualities of "rust preventing," "free of sediment," and "anti-clogging" to increase sales.

Indeed

SANTOLENE H-LV PROMISES TO BE THE MOST EFFICIENT, ASHLESS FUEL STABILIZER AND RUST INHIBITOR YET DEVELOPED FOR FUEL STOCKS

SANTOLENE H-LV is easy to handle and blend, pumps at temperatures as low as 15° F. It is insoluble in water; does not contribute to oil haze; cannot be extracted by water. SANTOLENE H-LV does not form or foster emulsions.

Your Monsanto representative will be glad to supply you test samples, or write:

MONSANTO CHEMICAL COMPANY
Petroleum Chemicals Department
Lindbergh & Olive Street Roads
St. Louis 24, Missouri

SANTOLENE: T. M. Monsanto Chemical Company

Monsanto®

See them Now!

Industry's MOST WANTED line of GENERAL PURPOSE VALVES

FOR PETROLEUM REFINERIES
CHEMICAL PLANTS • POWER PLANTS

Write for Supplement No. 1 to Catalog F-9

Address Dept. 24A-FO

MOST WANTED — that's right — because the G P line includes gate, globe, and angle type valves having seats faced with **HAYNES STELLITE*** alloy or other hard facing alloys for greater seat-wear resistance . . . at no extra cost!

Hard faced seats, in combination with precision finished, selectively hardened discs and wedges give these valves amazing resistance to erosion, corrosion and galling. That's why they are setting new standards of performance in steam, water, oil, or gas services at the recommended pressures and temperatures.

Get longer, drop-tight, service life with minimum maintenance by specifying Vogt G P Valves. Available in a complete range of sizes from ¼" to 2" and rated 800 pounds at 850°F. and 2000 pounds at 100°F.

HENRY VOGT MACHINE CO.
P. O. Box 1918—Louisville 1, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati

Vogt GENERAL PURPOSE GP Vogt FOR BETTER VALVES

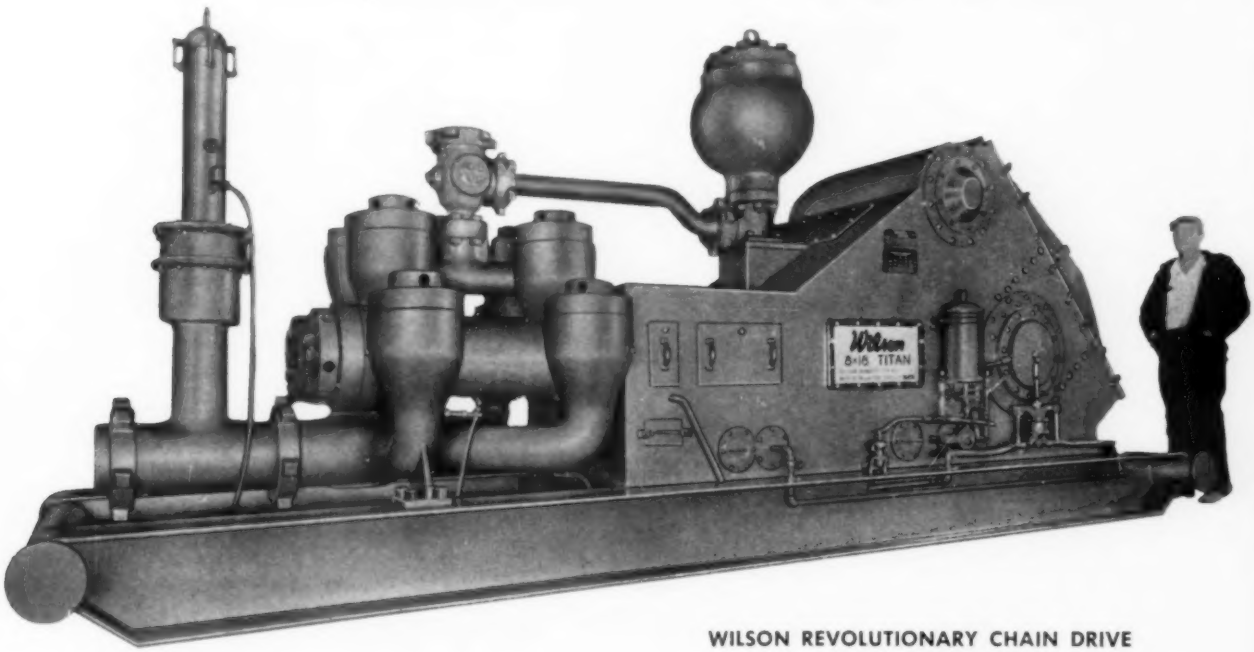
DROP FORGED STEEL

VALVES

*Trade-Mark of Union Carbide and Carbon Corporation

THE ANNOUNCEMENT THAT SURPRISED THE DRILLING INDUSTRY

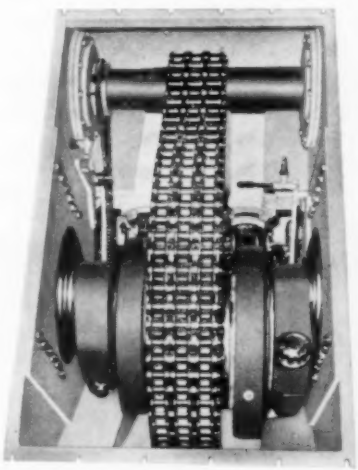
The New 1250-Horsepower Wilson Titan Slush Pump



WILSON REVOLUTIONARY CHAIN DRIVE MEANS NO GEARS

Think of it! A 1250-H.P. pump that weighs ONLY 35,300 lbs. complete with pistons, rods, liners, valves, skids and Suction Flow Equalizer. Half the weight of a conventional pump! — 28 lbs. per horsepower! Far less initial cost per horsepower. Far less upkeep! Every modern feature: • Chain drive • Welded steel frame • Alloy steel mud end • Quickly removable valve covers • Quickly removable cylinder heads • Works efficiently from 600 to 1250 horsepower. Write for special bulletin.

• *So why buy an overweight, gear driven, expensive obsolete pump?*

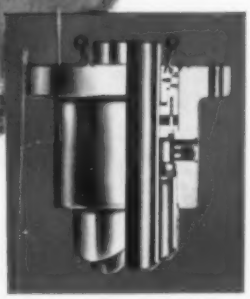


BE MODERN - BUY WILSON

Wilson

WILSON MANUFACTURING CO., INC.
Wichita Falls, Texas, U.S.A. — The Home of Red Iron

THE O·C·T C-20 CASING HEAD



lets you work in *Safety*

Regardless of how or when you decide to install the O-C-T "C-20" Casing Hanger . . . before cementing, after cementing, through preventers, under preventers, or at any time in case of stuck pipe . . . you can improve the safety of your completion operations and save hours of expensive rig time due to the flexible, simplified O-C-T installation procedure.

Let your O-C-T Representative give you all the details or write for complete information. Available through more than 700 supply store locations.

The first quick-setting, positive-sealing well head designed especially to eliminate open hole hazards in medium depth wells, the O-C-T "C-20" Casing Hanger can't forget to seal . . . because the sealing element, slip bowl and slips are assembled as a single unit that may be wrapped quickly around the casing, latched and dropped into place, eliminating the possibility of individual parts being installed incorrectly.

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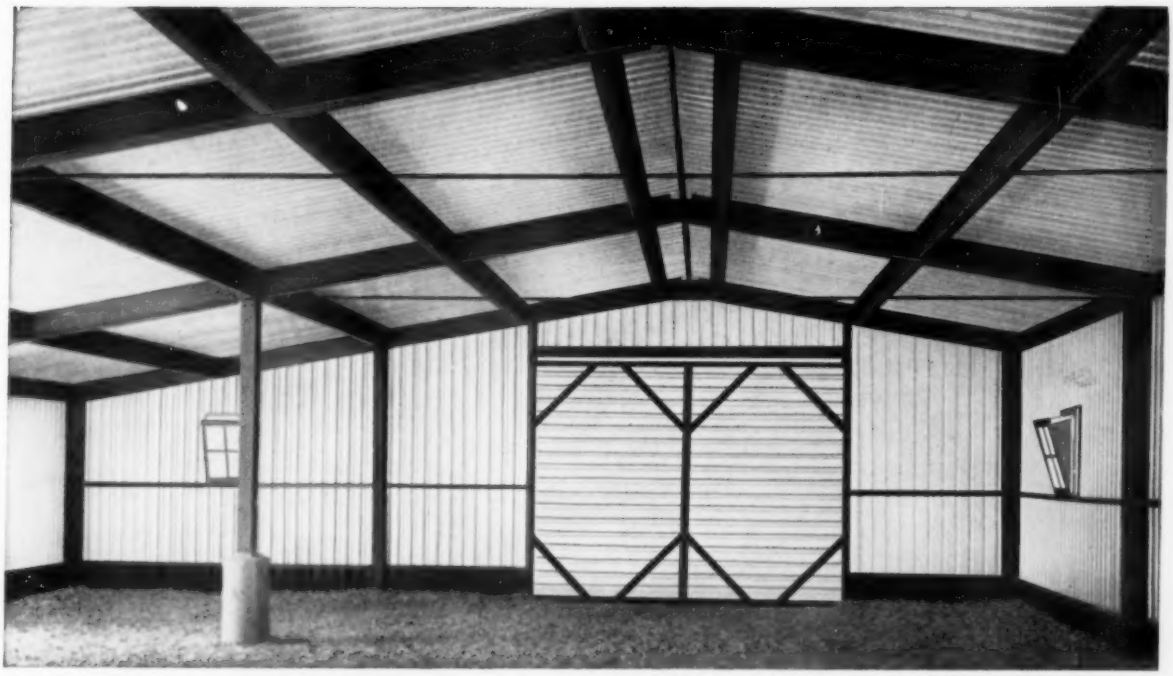
Export Representatives: South America — East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

FOR DUAL COMPLETIONS *Specify* O·C·T

The compact Oil Center Tool Company Christmas Tree assembly provides a safe, strong and practical means to economical dual completions.

If you are considering dual completions, it will pay you to check the features and get the full story of this O-C-T Dual Completion Assembly.

ASK US FOR MORE INFORMATION



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Stran-Steel dealers are listed in the Yellow Pages under *Steel Buildings* or *Buildings—Steel.*

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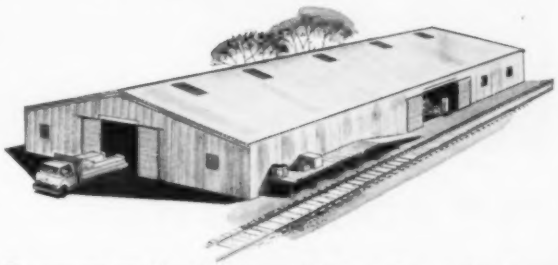

Permanent good-looking Stran-Masters offer quality housing for business and industry at lowest cost per square foot.

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reports "Red" Royal

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Because this hard-working mammoth requires the champ rotary hose in the industry, U.S. Royal 4 was selected—not only for its unequalled record on barge rigs, but also for its performance in the patches throughout the oil fields.

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THE HOUSTON POST

ANXIOUS ZOOMAN TOM BAYLOR AND HIS CARPENTER'S RULE
The Fast-Growing Hippos Are Abbie and Durka

40-POUND LUNCHES

Hippo Spread Real City Zoo Problem

By CLIFF BLACKBURN

A race with time, the weather, and the appetites of two baby hippos started Wednesday at the Hermann Park Zoo.

Zoo Manager Tom Baylor stood in the animal hospital and anxiously watched Abbie and Durka, 18-month-old female hippopotamuses, delicately crunch their lunches.

Each lunch consisted of about 40 pounds of grain, lettuce, carrots and apples.

WHEN THEY had finished eating, Baylor measured their hip spans with his carpenter's rule. Then he measured the hospital door.

"I think we're going to make it," he announced. "It's going to be close, but with luck we'll make it."

The problem is really such a simple one that it wasn't noticed until recently.

The door measures 31 inches across. The hippos, growing like mad, now measure 30 inches across the hips.

When the hippos arrived from Africa last May, their shipping crates were 28 inches wide, 48 inches long and 26 inches wide. The weight of each hippo and crate was 206 pounds.

ABBIE AND Durka now weigh about 425 pounds each and are 30 inches wide, 5 feet long and 32 inches high.

"I had them moved into the hospital because of bad weather," Baylor explained. "By Easter it will be warm enough to put them outside again."

At their present rate of growth, Baylor figures that Abbie and Durka will each be 5 pounds heavier by Easter Sunday.

"That couldn't possibly put another two inches on their hips," he said nervously.

He opened the door and looked out at the sunshine.

"It's going to be a tight squeeze, I know," he said. "The real danger is if we have another norther."

Sam Rogers, President, Rogers Geophysical Company, shown here with Abbie and Durka shortly after their arrival from Somaliland.

ROGERS CREWS HAVE EXPANDED, TOO

Less than a year ago when Abbie and Durka were presented to Houston's Hermann Park Zoo by Sam Rogers, President of Rogers Geophysical Company, they weighed approximately 200 pounds each. They have now more than doubled their weight to about 425 pounds each, as outlined in the story from the Houston Post.

Rogers Geophysical Company has put on some weight, too—where it will do the most good. There are now fifteen Rogers crews working on a world-wide basis . . . so you can see Rogers has been expanding, too.

World-wide experience, and operating under practically every known condition, has given Rogers crews the "know-how" for making accurate geophysical surveys.

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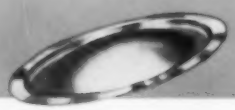
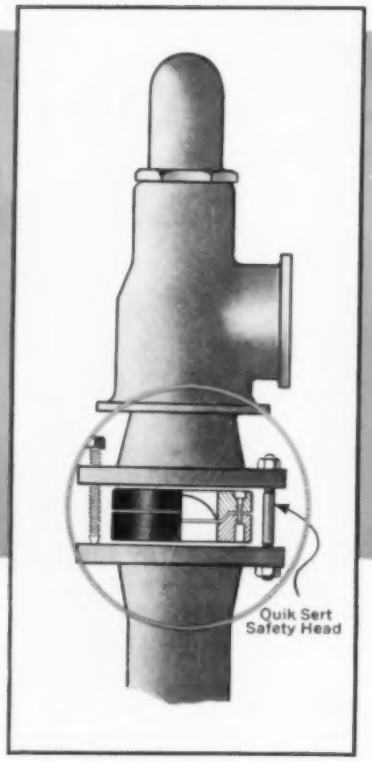
You Can Prevent These Three Relief Valve Problems With a BS&B Quik-Sert *Safety Head!*



BEFORE

AFTER



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"Freeze-ups"

The BS&B Quik-Sert Safety Head isolates the relief valve from the product under pressure. Mounted under the valve inlet, it is "bottle tight" until overpressure reaches the rated pressure of the preformed metal rupture disc.

The Quik-Sert Safety Head flange assembly is located inside the bolting of companion flanges. Easy insertion and removal is accomplished through the use of jack screws.

A BS&B Quik-Sert Safety Head Under the Relief Valve Gives You These Advantages

- Stops product loss at normal operating pressures
- Assures proper valve function at set pressure
- Lowers maintenance costs
- Reduces shutdown time

BS&B engineers will be glad to evaluate your pressure system for proper applications of the Quik-Sert Safety Head.

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Safety Head Division, Dept. 2-A6
7500 East 12th Street, Kansas City 26, Missouri
Telephone: BEnton 1-7200

CALENDAR

JUNE

15-19 American Society of Mechanical Engineers, semiannual meeting, Hotel Statler, Detroit.
19 Pennsylvania Grade Crude Oil Association, annual meeting, Penhills Club, Bradford, Pa.
18-28 British Chemical Plant Manufacturers' Association, Council of British Manufacturers of Petroleum Equipment, chemical and petroleum engineering exhibition, London.
20 Southern Gas Association, transmission section, dispatchers' roundtable conference, Noel Hotel, Nashville, Tenn.
22-27 American Society for Testing Materials, annual meeting and exhibit, Hotels Statler and Sheraton-Plaza, Boston.
23-25 Interstate Oil Compact Commission, midyear meeting, Hotel Utah, Salt Lake City.
25-26 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Broadview Hotel, Wichita.
24-27 Canadian Gas Association, fifty-first annual meeting, Manoir Richelieu, Quebec.
28-July 2 Petroleum Equipment Suppliers Association, twenty-third annual meeting, Chateau Frontenac, Quebec.

JULY

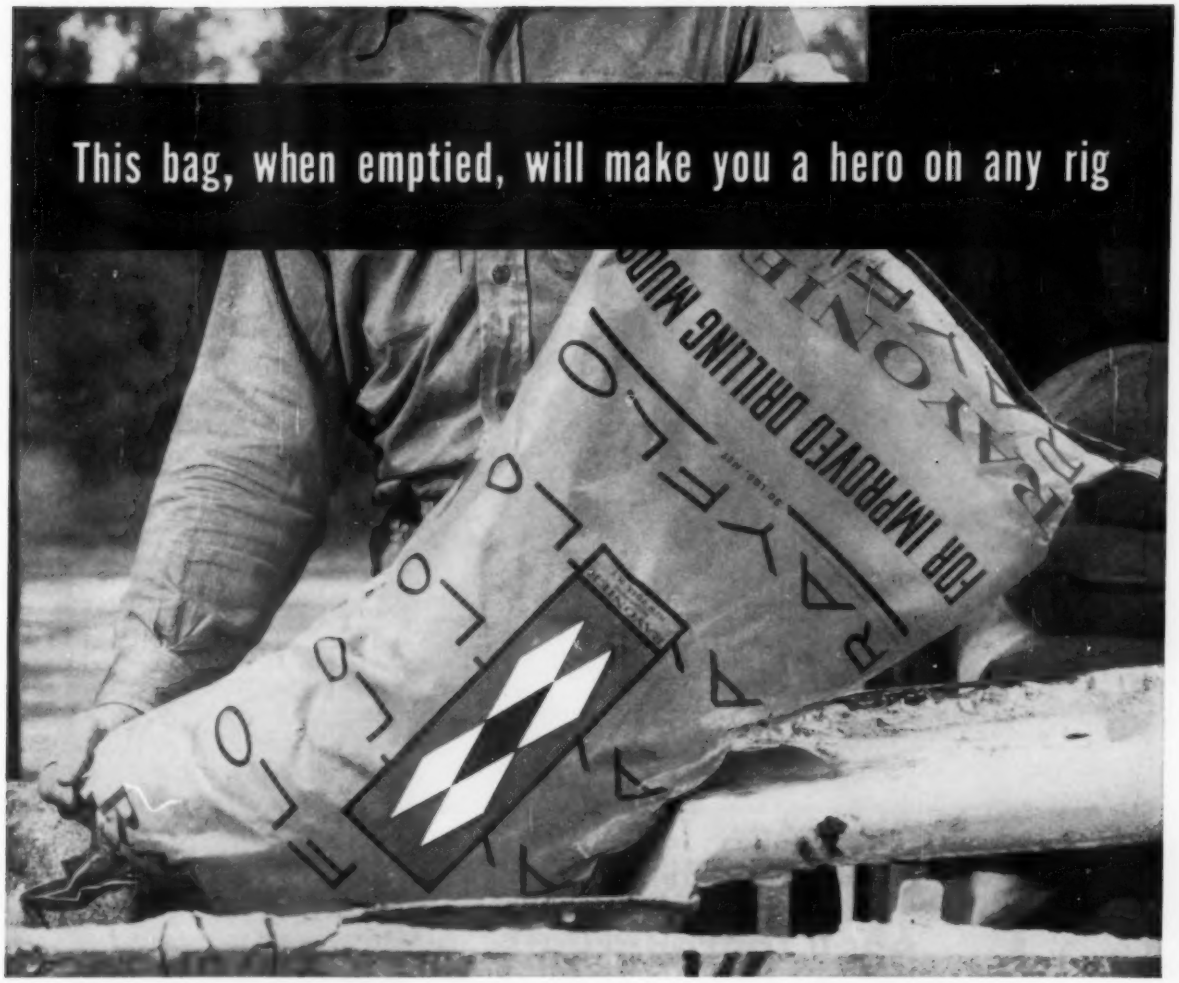
23-26 Wyoming Geological Society, thirteenth annual field conference, Powder River basin.

AUGUST

11-14 Society of Automotive Engineers, National West Coast meeting, The Ambassador, Los Angeles.
19-22 American Institute of Electrical Engineers, general meeting, Sacramento.
25-27 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

SEPTEMBER

7-12 American Chemical Society, fall meeting, Chicago.
10-12 National Petroleum Association, fifty-sixth annual meeting, Traymore Hotel, Atlantic City, N. J.
10-13 Intermountain Association of Petroleum Geologists, ninth annual field conference, Paradox basin.
15-16 Independent Natural Gas Association of America, annual membership meeting, Roosevelt Hotel, New Orleans.
15-17 American Institute of Electrical Engineers, conference on petroleum, Baker Hotel, Dallas.
18 Natural Gasoline Association of America, Rocky Mountain regional meeting, Gladstone Hotel, Casper, Wyo.
21-24 American Society of Mechanical Engineers, petroleum division, mechanical engineering conference, Cosmopolitan Hotel, Denver.
24-25 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.
25-26 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.



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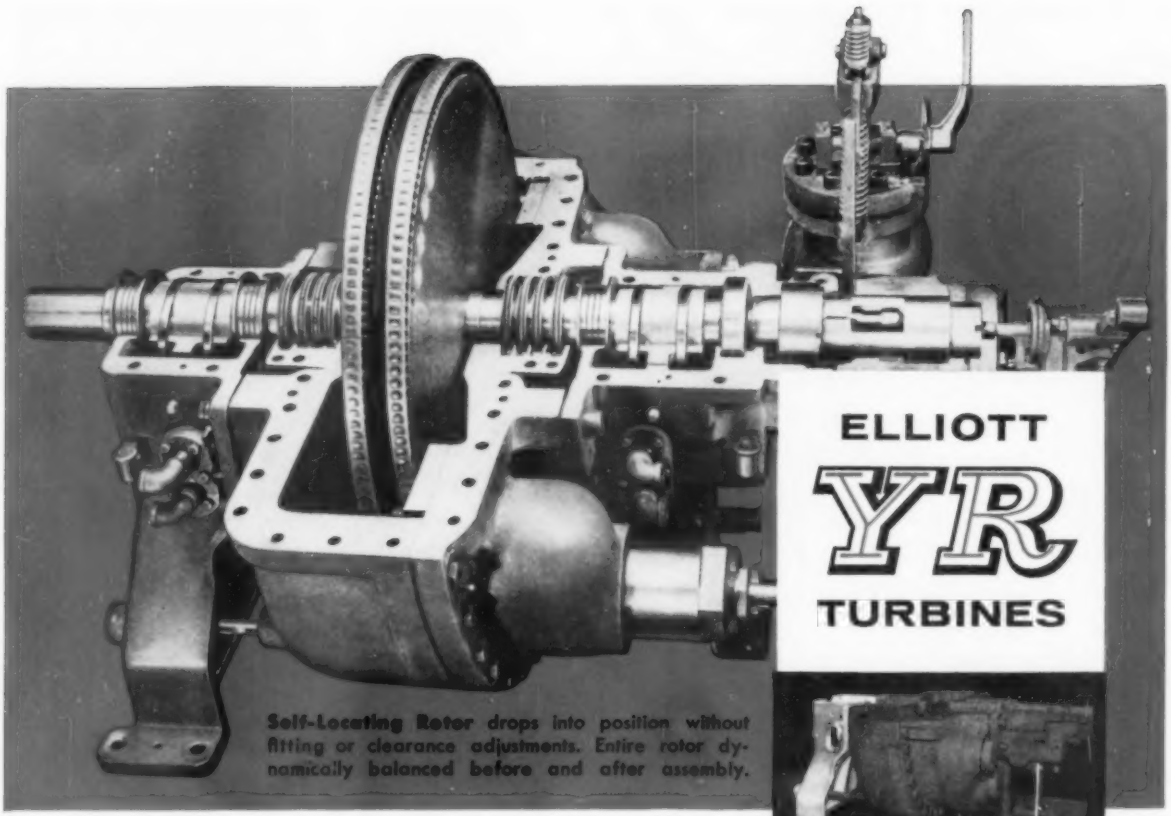

Self-Locating Rotor drops into position without fitting or clearance adjustments. Entire rotor dynamically balanced before and after assembly.

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TURBINES

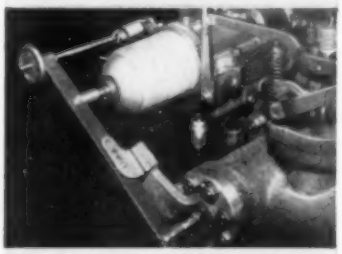
True Centerline Support assures accurate shaft alignment over entire range of operating temperatures, extends life of bearings of turbine and driven machines.

5 design features insure ...easy installation ...easy maintenance

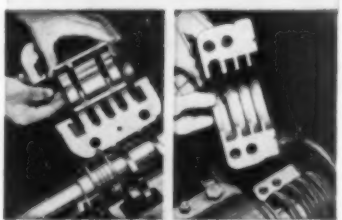
Dependability in long-term, continuous service is the principal reason why Elliott mechanical drive turbines have won such universal acceptance as prime movers for process and water pumps, fans, compressors and other driven machines.

But there's more to it than that. The popularity of Elliott YR single-stage turbines, in sizes from 2 to 600 hp, is also due to simplified design features which provide easy installation and easy access for routine inspection and maintenance. Five of these design features are illustrated here. The Elliott design also permits interchangeability of components from one turbine frame to another.

Other types of Elliott mechanical drive turbines are available, in sizes up to 20,000 hp. And when it comes to application engineering or maintenance assistance, your local Elliott field engineer is always available. For complete details write Elliott Company, Steam Turbine Department, Jeannette, Pa. Ask for Bulletin H-22B.



Weather-Proofed, Reliable Speed-Governing System maintains effective steam seal for long operating periods. Separate overspeed trip gives positive overspeed protection.



Liner Type Bearings (left) are sealed against elements, permit rapid heat transfer to cooling oil, are easy to inspect or replace.

Accessible Shaft Seal Covers (right) are easy to remove for inspection or ring replacement.

ELLIOTT Company

TURBINES FOR DEPENDABLE day-in/day-out SERVICE

29-Oct. 3 Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum, and aircraft engineering display, The Ambassador, Los Angeles.

OCTOBER

1-2 Western Petroleum Refiners Association, third annual stream-pollution and waste-disposal conference, Lassen Hotel, Wichita.

1-3 American Association of Oilwell Drilling Contractors, eighteenth annual meeting, Adolphus and Baker Hotels, Dallas.

5-8 Society of Petroleum Engineers of AIME, fall meeting, Houston.

5-8 National Association of Corrosion Engineers, northeast region, Somerset Hotel, Boston.

7-8 Texas Mid-Continent Oil and Gas Association, annual meeting, Statler-Hilton Hotel, Dallas.

12-18 OIL PROGRESS WEEK.

13-15 American Gas Association, annual convention, Atlantic City, N. J.

13-15 American Society of Mechanical Engineers, American Society of Lubricating Engineers, conference on lubrication, Statler Hotel, Los Angeles.

13-16 Society of Exploration Geophysicists, annual meeting, Hotel Gunter, San Antonio, Tex.

13-17 American Society of Civil Engineers, annual convention, Hotel Statler, New York.

15-16 South Dakota Independent Oil Men's Association, convention, Sheraton-Johnson Hotel, Rapid City.

15-17 National Association of Corrosion Engineers, north central region, Cincinnati.

16-17 Society of Petroleum Engineers of AIME, Southern California petroleum section, Biltmore Hotel, Los Angeles.

19-21 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Adolphus, Dallas.

20-24 National Association of Corrosion Engineers, south central region, Roosevelt Hotel, New Orleans.

22-23 National Association of Corrosion Engineers, western region, corrosion control course, U. S. Grant Hotel, San Diego, Calif.

22-24 Southwestern Federation of Geological Societies, technical meeting, Mineral Wells, Tex.

22-24 Society of Automotive Engineers, national diesel engine meeting, Lord Baltimore Hotel, Baltimore.

23-24 Western Petroleum Refiners Association, refining technology and industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

27-28 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-31 American Institute of Electrical Engineers, general meeting, Pittsburgh.

NOVEMBER

5- 6 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6- 7 American Association of Petroleum Geologists, Pacific section annual meeting, Los Angeles.

10 Transportation Club of the Petroleum Industry, annual meeting, Bismarck Hotel, Chicago.

10-13 American Petroleum Institute, thirty-eighth annual meeting, Conrad Hilton, Palmer House, and Congress hotels, Chicago.

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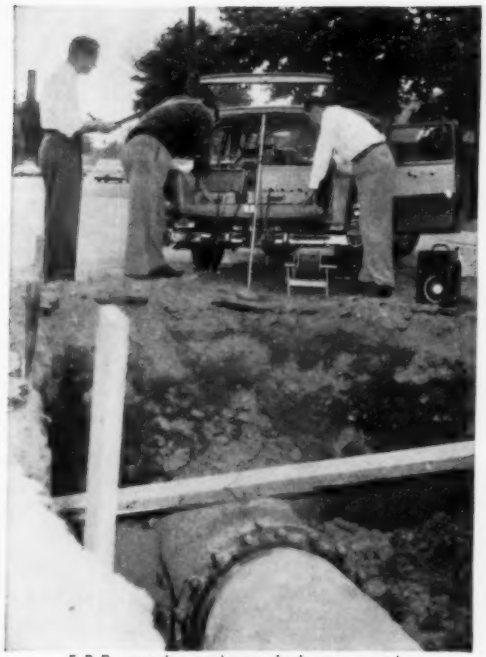
makes the difference in pipeline cathodic protection



E. R. P. corrosion engineers check an exposed leak area. Here they correlate pipe potential and line current measurements for electrolysis.

It takes a lot of know-how to protect a pipeline from corrosion. That's why corrosion engineers at E.R.P. keep abreast of the latest instrumentation. Whether they are protecting an old pipeline or preventing corrosion on a new line, they use every modern method to be sure each cathodic system is as effective as possible.

That's what makes the difference in E.R.P. cathodic protection: engineering when the cathodic system is designed; when it's installed; when periodic corrosion surveys are made to check for environmental changes.

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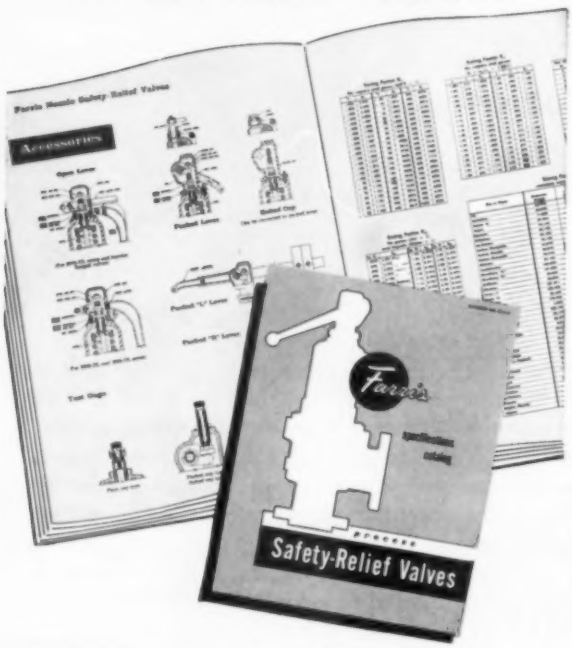

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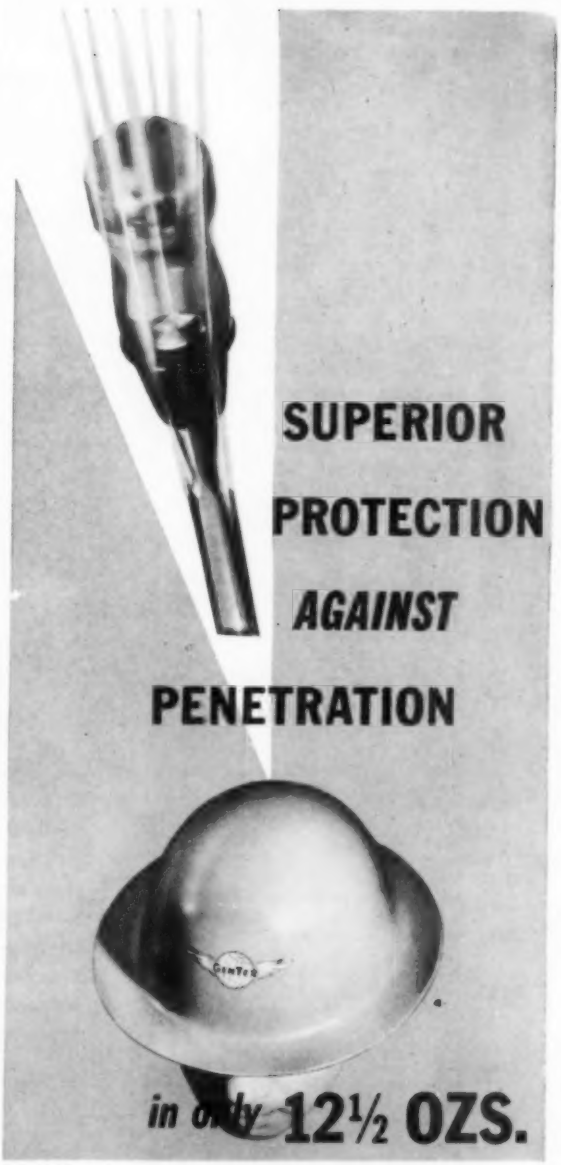

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They Say—

Persian Gulf potpourri

Dear Sir:

Competition surely makes strange bedfellows. Indiana (Standard of Indiana) has just bid in a huge chunk of the Persian Gulf that makes it a (sea) bedfellow of the Italians on one side and, out on the median line of the gulf, of the Japs on the other. This should be fun to watch.

George F. Prussing
Regional Petroleum Officer
American Embassy
Beirut, Lebanon

Sure cure for bootlegging?

Dear Sir:

I read in the Journal that Mr. John L. Sanders, Hobbs, N. M., is having trouble with people stealing his condensate (They Say, "Bootlegging in New Mexico," May 26, p. 37).

I was at Hobbs for 9½ years as superintendent for Sinclair Oil & Gas. I tried every trick in the book to stop it with no success. Finally I put a small amount of crude in it. They left it alone.

N. B. Rhees
Chase, Kans.

Cost of making a million

"Our company's 1957 annual report . . . shows that net profit of $96,209,353 was about $1,000,000 more than in 1956. Gross income of $1,136,892,901 was about $98,000,000 over the previous year's.

"Thus, it took nearly a hundred million dollars of additional sales income to make one million dollars more of net profit.

"The fact that the rise in profit was such a small percentage of the increase in gross income is another indication that we are caught in a very tight cost-price squeeze.

"Phillips was one of the few larger oil companies to show an increase in earnings over 1956 . . ."

K. S. Adams, chairman of the board, Phillips Petroleum Co., in "Philnews," company magazine.

Hidden tax penalizes capital

"A locomotive crane that U. S. Steel purchased in 1945 cost almost twice as much to replace 3 years ago, and a new blast furnace that was installed last year required a capital outlay five times greater than in 1930.

"The significance of all of this lies in the fact that the basic idea of depreciation—providing a revolving fund for the replacement of tools and facilities—has been undermined by the vast shrinkage which has occurred in the purchasing power of the dollar.

"Because current depreciation laws fail to take this into consideration, it has been estimated that American industry had to declare as income in 1956 some six billion dollars that should have been carried on the books as depreciation allowances . . .

"We cannot afford the 'hidden tax' on capital which currently exists. Instead, depreciation must become —in reality as well as theory—a means of maintaining capital investment by giving it a sound basis."

Clifford H. Hood, president, United States Steel Corp., in a speech to the Blue Valley Manufacturers' and Business Men's Association, Kansas City.

U. S. capital in Canada

"Since the war, one out of every five dollars of Canada's gross national product has been put into capital betterment—more in recent years. This is the highest rate in the western world.

"It is a fair assumption that all available Canadian capital has been fully employed either at home or abroad. In the oil business alone a new investment of more than a million dollars a day is required. In the face of such a staggering requirement Canada cannot go it alone . . .

"Very nearly half of the capital employed in petroleum, mining, and manufacturing in 1954 was in U. S. controlled firms and in all probability the proportion has increased during the last 3 years. In comparison, the equivalent percentage in 1948 was less than 40% . . .

"There is no evidence to indicate Canadians are either more or less conservative than Americans in their investment policies. But the population of the U. S. is ten times as large as that of Canada, and per capita income in that country is approximately 20% higher. Thus in the U. S. there is a much greater supply of capital than in Canada.

"While U. S. capital forms a rela-

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B and W Rotating Scratchers
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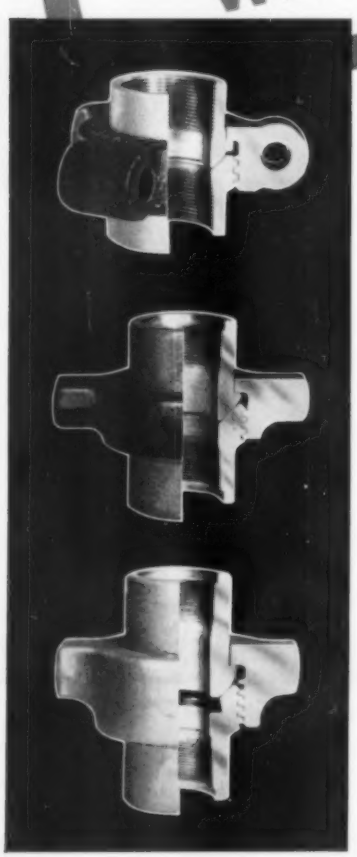

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Full circle contact of the ball and cone metal-to-metal seats always makes a tight seal.

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W. M. V. Ash, president, Shell Oil Co. of Canada, Ltd., in a speech to the Western Canada Conference on Financial Management and Petroleum Accounting, Banff, Alta.

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Dr. Theodore E. Allen, associate medical director, Socony Mobil Oil Co., Inc., in a speech to Dartmouth College business - administration students.

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"Even with a marked decline in the rate of growth in consumption of petroleum products from the phenomenal growth rate in the postwar period, we can foresee an increase in demand over the next 10 years, which, in terms of volume consumed, will exceed the increase in demand over the last 10 years."

M. S. Beringer, president, British American Oil Co., Ltd., in a speech to shareholders.

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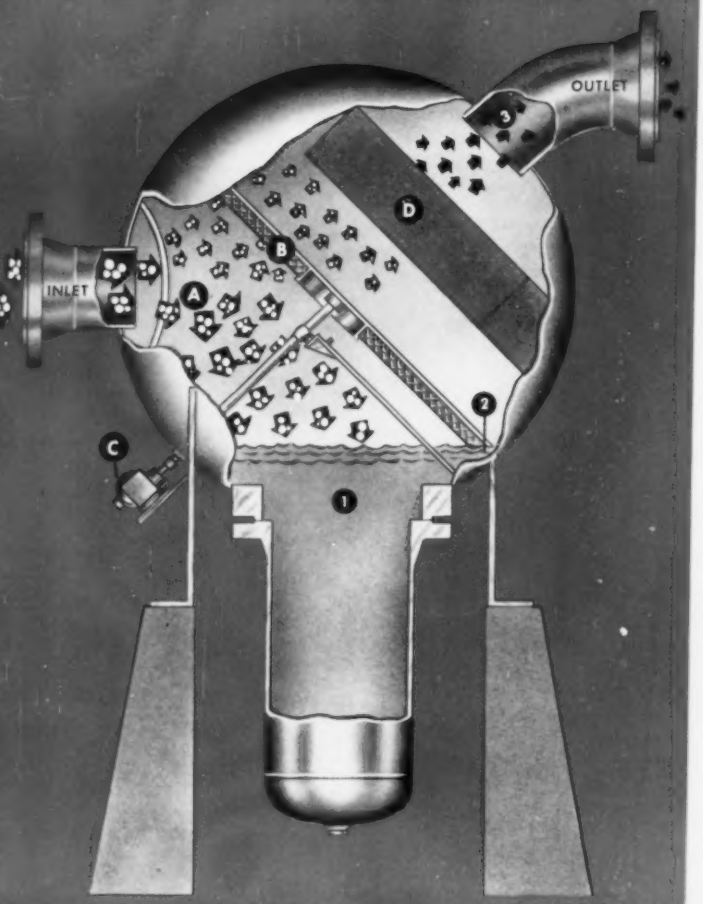

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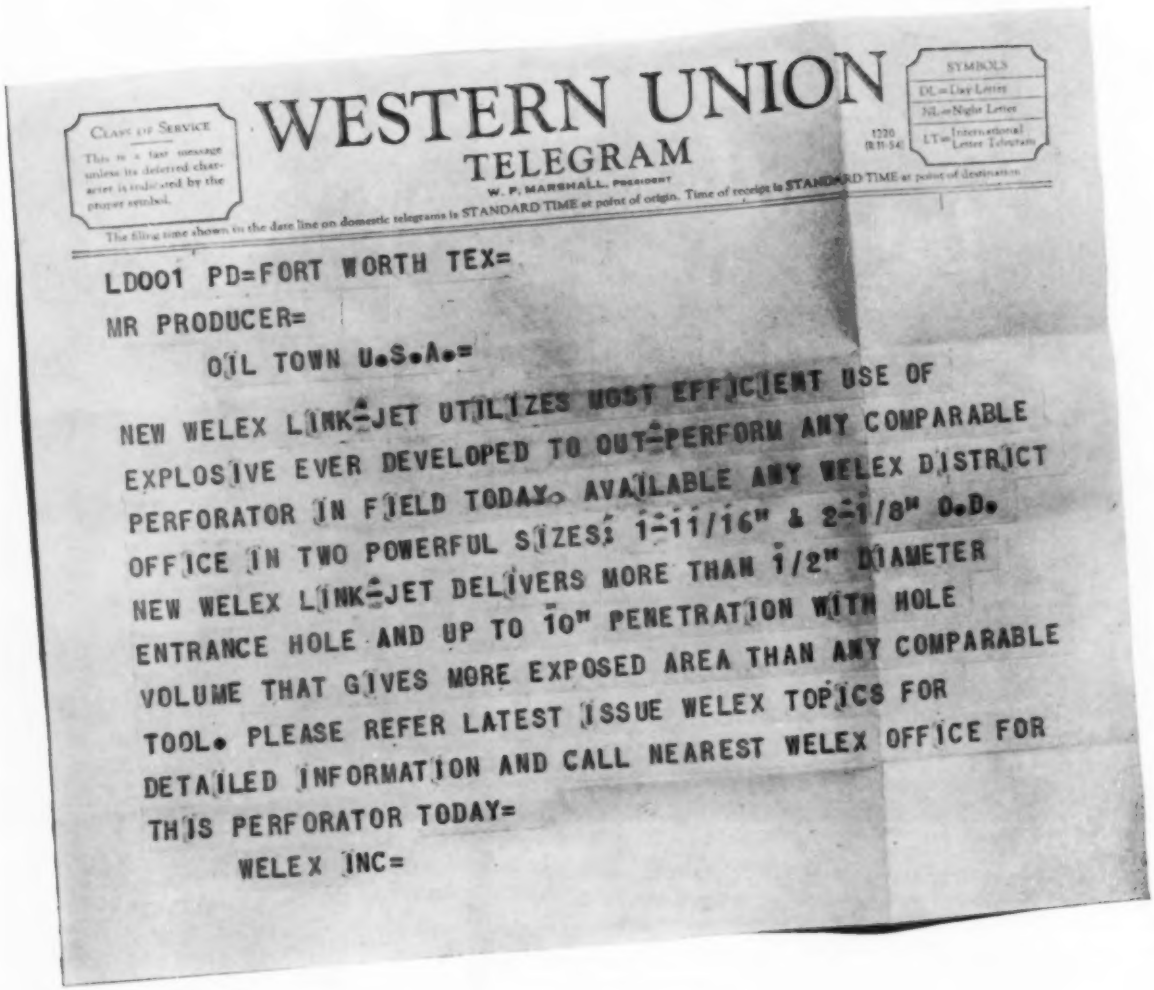

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JOURNALLY SPEAKING

Inside Venezuela

LIKE WE ALWAYS SAY, newspapermen have more fun than anybody.

Like on this trip to Venezuela, where a bunch of oil writers "helped" the Venezuelan airline (LAV) inaugurate a new nonstop flight direct from New Orleans to Maracaibo.

A lot of other VIP's from both countries helped, too, but these others couldn't have had half as much fun as we did because they had to hold up their dignity whereas the oil writers just barely managed to hold up themselves.

This new flight is quite the berries. Dinner in New Orleans' French Quarter and breakfast over Venezuela's oil capital. How about that? It's supposed to appeal to southwestern oil men who more or less commute to Venezuela—which, come to think about it, may have been the reason the oil writers were invited.

Our own view, however, was that this junket made us all experts on Venezuela and its oil industry. If John Gunther can write a book about a country after being "inside" it for only a couple of days, we ought to be able to speak with equal authority, though we must admit that perhaps our trip was just a bit special.

If we saw no signs of political unrest or Communist-inspired agitation against Americans, it may have been because the LAV and other hosts whisked us so fast from one reception to another. Nobody threw any stones at us. In fact, the only things thrown at us were food, drink, and questions as to what Congress will do about clamping down on U. S. imports of Venezuelan oil.

And the closest thing to a riot was when one of the Texas oil writers asked how many producing days Venezuela had and was told "365 except on leap year, when it's 366." A possible international incident was avoided when somebody shoved another drink in the Texan's hand and changed the subject quickly.

Venezuelan customs are very quaint, so far as we were able to observe. Based on our own experience we can report that the national pastime is cocktail parties, the native drink is Scotch, and the principal diet consists of caviar and filet mignon. And nobody gets any sleep.

In between banquets, receptions, and cocktail parties, we did manage to get a bird's-eye view (or bloodshot-eye view) of those fabulous oil operations in and around Lake Maracaibo—thanks to Creole Petroleum Corp. which disrupted a day's work of a dozen officials to junket us all over the area by boat and bus.

We can report that those derricks out in the lake are just the way they look in the pictures. With so many Creole officials at hand to answer all questions (such as where's the bar?, and how's the fishing in the lake?) we naturally became expert on the Venezuelan oil industry, but we won't bother to report on it here because it has all been so well covered in other issues of our favorite oil publication.

Our research work (cocktail-party conversation) was directed chiefly along politico-economic lines. We learned that Venezuelan and U. S. oil producers have much in common: They both wonder where they're going to find somebody who'll buy their oil. Beyond that, certain differences in viewpoint are apparent.

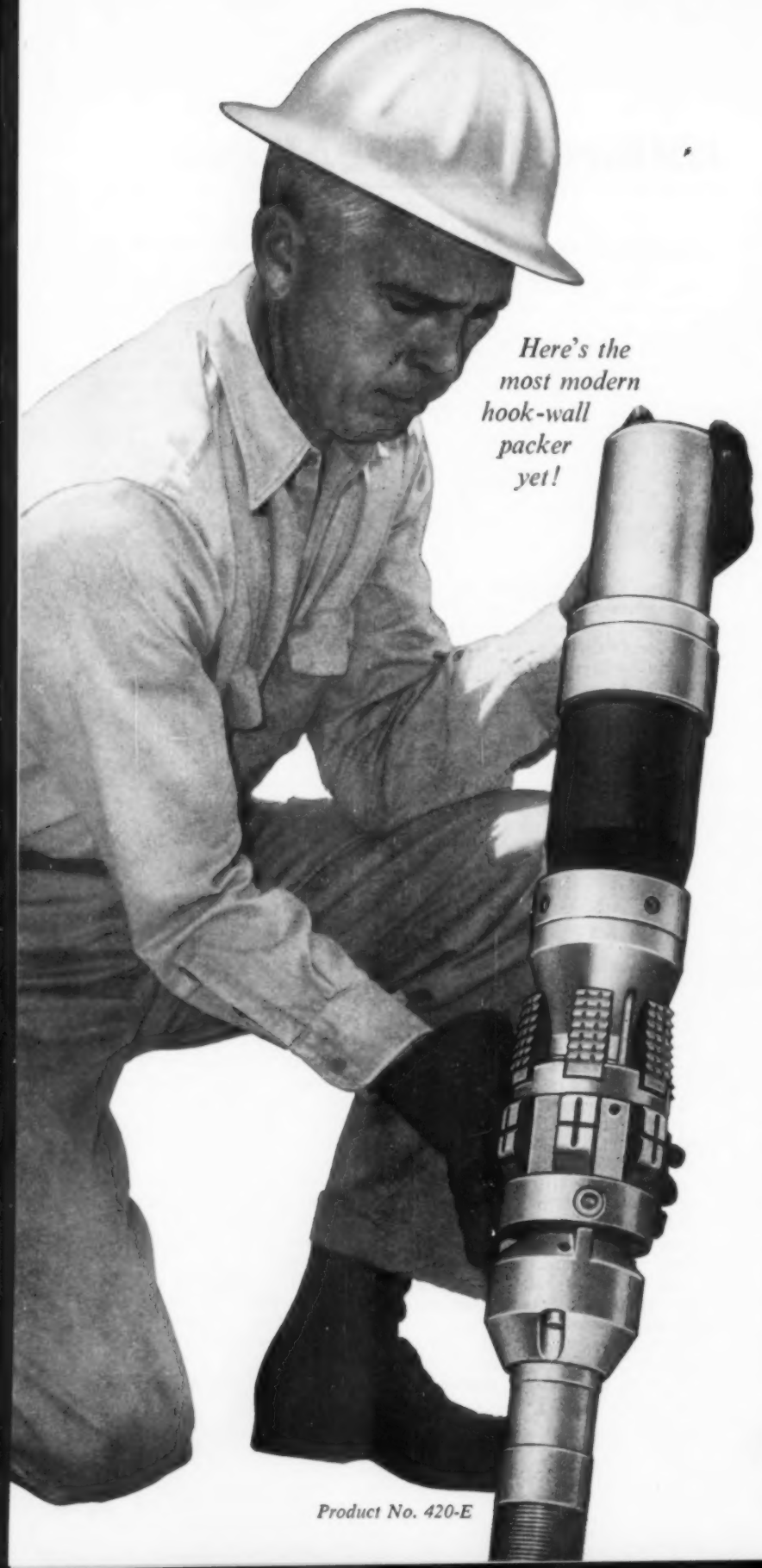
The Venezuelans feel that U. S. independent producers don't appreciate their position and don't try to understand their problem. (That's news?)

The reverse is also true. We ambassadors of good will did our best to explain the American way of life—i.e., proration and preservation of marginal wells—but there seems to be a gulf of misunderstanding which even a dozen highballs fail to bridge.

All in all it was a most educational trip. We all were duly impressed with Venezuela's scenic, architectural, and gastronomic attractions, and with the vigorous qualities of its hospitality and its oil industry.

But didn't we competing oil writers try to scoop each other on oil news? Who cared about oil news? This trip was for fun, and like we always say. . .

—Henry D. Ralph



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Will producers head the public hate list?

PUBLIC criticism of the oil industry these days seems to be directed chiefly against producers.

The villain of an older generation was always "Standard Oil." Now it's more apt to be "Texas oil barons" and other independent producers—all ipso facto "filthy rich," "tax exempt," and "indifferent to public welfare."

This shift in whipping boys may be due to the fact that producers have come into prominence through discussion of the natural-gas bill, depletion provision, and crude imports. It may be because the major companies have convinced the public that there is competition among them and that their control is widely spread and their earnings reasonable.

WHATEVER THE CAUSE, the dangers to the producing end of the industry are obvious. Independent producers are liable to get blamed for every unpopular thing the industry does, and for a lot of things it doesn't do.

The solution is not to launch a diversionary attack by advertising alleged sins of the pipelines, the refiners, the marketers, the importers, or some other group that might be "worse" than producers.

The solution is to make the man in the street better informed about what kind of human beings produce oil, how they live, and what problems they are up against. This calls for a patient, grass-roots, educational program.

Fortunately, the stage is being set for just this sort of public-relations work. The API is in the process of setting up a new department of public affairs to combine the specialized government-relations work of the APIC and the generalized public-relations program of the OIC, and to reorient and improve them both.

Among the aims of this reorganization are the intention to work more on the state and local level and to pinpoint specific problems of public misunderstanding. Advice from the whole industry is being sought on how to accomplish this.

Here is both an invitation to independent producers to influence the course of the new program, and an opportunity to use the API's extensive organization to explain the producer's position.

IN ADDITION, the IPAA is getting its own public-information program off to a good start, and a large number of state and regional associations of producers are working on similar plans.

It would be sad indeed if these various programs operate at cross purposes. But there is no reason why they should not dovetail.

But the most important thing is that individual producers themselves take part in these or similar public-relations activities. Otherwise they may find themselves at the top of the public's hate list.

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▶ ▶ ▶ News Section

What Texas' Pipeline Order Means

• It sets up a framework to force common carriers to connect wells. But it's neither rigid nor arbitrary, and only through many hearings and perhaps several court tests will its precise application become clear.

INDEPENDENT producers appear to have won a major victory in the first round of their fight to get more oil wells connected to pipelines in Texas.

In an historic order earlier this month, the Texas Railroad Commission laid down general "ground rules" under which common-carrier lines should connect a well on request of the producer.

Previously, the commission had declined to directly order common-carrier lines to make connections, although it sometimes had been able to achieve the same end indirectly.

The change in commission philosophy may prove to be the most important since the Texas conservation agency decided to crack down on gas flaring by shutting in offending wells and fields.

Too, the new order appears not only to affect the common-carrier lines but likely the common purchasers as well. It appears probable at this stage that the commission, if it sees an application for well connection justified by evidence, will not only order the pipeline to connect the well but in some cases order the common purchaser to buy it.

The order is couched in general terms intentionally. There are many factors to consider in deciding if a well merits connection to a pipeline. And at present neither producer nor pipeliner can be certain of his ground. More specific standards for making connections await hearings by the commission on specific cases—and there may be many—and perhaps later tests in courts.

Eventually, the commission hopes both pipeline and producer will know by past decisions when a well must be connected and when it doesn't merit connection. Pipelines then, the commission thinks, will proceed to connect wells which should have pipeline outlets without waiting for a hearing —just as producers now take steps to prevent gas flaring when such flaring would defy commission policy set in past similar cases.

What it says . . . Common-carrier lines, the order holds, must connect lease batteries on application by the producer to the carrier:

. . . Within a field when any common carrier has the only pipeline serving this field or common reservoir.

. . . Within the general area served by a common carrier which is an affiliate or subsidiary of a common purchaser.

The commission places the burden of proof on the carrier to justify its failure to make a connection.

Its order states that "for just cause, common-carrier pipelines may seek exceptions to the rules set out." A line's application for exception would be dealt with at a hearing following 10 days' notice to all affected parties.

Producers may also file complaints with the commission for "failure to connect" under the new rules or the appropriate statutes.

In either case, the commission would require and consider at a hearing evidence relating to the ability of the line to transport the type of oil involved, the market or lack of market for the tendered oil, the period required to return the capital investment for the connection, and other factors.

What it means . . . Producers in recent years have complained increasingly of getting the runaround from common carriers and common purchasers when seeking a connection. The fussing has become more pronounced with the growing domestic oil surplus.

They complain that the common-carrier line will not take their oil unless it has a buyer, and that the line's common-purchaser parent won't buy the oil because it says it has all it wants.

Unable to dent this stone wall, the producer has to truck his oil, if he can find a buyer, at what amounts to a discount below posted price due to high trucking rates. This, the producers claim, is discrimination prohibited by Texas statutes.

Commission sources indicate that the current order is aimed in part at cracking this producer-alleged "stone wall."

Here, these sources say, is how it may work in a field or reservoir served by only one common carrier:

The owner of an unconnected well can call for a hearing if the carrier refuses to connect his well. If at the hearing the commission finds the well to be comparable in location, reserves, type of oil, and daily production to other wells in the field, it will order the carrier to connect.

Alleged absence of market will have no bearing on the decision. The common purchaser buying oil from other wells in the field will be told to buy oil from the unconnected well whether or not it wants or needs the oil. If necessary, the commission will order production of other wells in the field cut back so that the purchaser can take the volume of oil it needs ratably from all wells.

The same sort of treatment would take place in a field where there were more than one carrier, these sources say, despite the fact that such an instance wasn't mentioned in the order.

The decision here would be tougher because the commission would have to decide which carrier should be ordered to connect.

The commission is not expected to have occasion to rule on many such instances, however, in that a minority of Texas' unconnected wells fit in this category.

The area problem . . . The most far-

Here's the Basis for Texas Pipeline Order

THE RAILROAD Commission June 4 held that existing Texas conservation statutes under Title 102 give it the power to prevent discrimination in oil movement and purchases within and between fields in the state. It further decided that "failure to make connections in compliance with the purpose and intent of these statutes results in (such) discrimination."

The order is one which likely will prove historic.

The commission based it on the following excerpts from the Revised Civil Statutes of Texas which hold that common carrier oil pipelines shall:

. . . "**Receive and transports** crude petroleum delivered to it for transportation and shall so receive and transport same and perform its other duties with respect thereto without discrimination." Article 6048.

. . . "**Exchange crude petroleum tonnage** with each like common carrier" . . . and "install and maintain facilities for the receipt and delivery of crude petroleum of patrons at all points on such pipeline." Article 6049.

. . . "**Extend or enlarge** such pipelines, or storage facilities, provided such extension or enlargement shall be found to be reasonable and required in the public interest and that the expense involved will not impair the ability of such common carrier or public utility to perform its duty to the public." Article 6049A, Section 7.

. . . **Not "discriminate** between or against shippers in regard to facilities furnished or service rendered or rates charged under the same or similar circumstances in the transportation of crude petroleum; nor shall there be any discrimination in the transportation of crude petroleum produced or purchased by itself directly or indirectly. In this connection the pipeline shall be considered as a shipper of the crude petroleum produced or purchased by itself directly or indirectly and handled through its facilities. . . . When there shall be offered for transportation more crude petroleum than can be immediately transported, the same shall be equitably apportioned. . . ." Article 6045.

. . . **Not "abandon** any of its connections or lines except under authority of a permit granted by the Railroad Commission, or with written consent of the owner or duly authorized agent of wells to which connections are made. . . ." Article 6049A, Section 6A.

The commission cited further excerpts from the statutes which say that any common purchaser in Texas shall:

. . . "**Purchase oil offered it** for purchase without discrimination in favor of one producer or person as against another in the same field, and without unjust or unreasonable discrimination as between fields in this state. . . ." (If common purchaser is also an affiliate of a common carrier or is itself a common carrier.) "It shall be unlawful for any such common purchaser to discriminate between or against crude oil or petroleum of a similar kind or quality in favor of its own production, or production in which it may be directly or indirectly interested . . . such production shall be taken in like manner as that of any other person or producer and shall be taken in the ratable proportion that such production bears to the total production offered for market in such field. . . ." Article 6049A, Section 8.

. . . **Be subject to "commission . . . inquiry** in each field concerning the connections of the various producers and when discrimination is found to be practiced by any common purchaser . . . order to such common purchaser to make such reasonable extensions of their lines and such reasonable connections as will prevent such discrimination." Article 6049A, Section 11D.

. . . **Be subject to commission order** after investigation "defining the distance that extensions or gathering lines shall be made to all oil or gas wells; and such other rules, regulations or orders as may be necessary to carry out the provisions of this act, and to prevent discrimination in purchases." Article 6049A, Section 8B.

reaching part of the order is that dealing with connections in "the general area served by a common carrier."

In this category would fall discovery wells. And there are many of these not connected in areas thickly dotted with small, not-too-prolific fields. Here probable commission action is not so clear cut.

It is under this portion of the order from whence most producer complaints will be heard and most of the attacks on the commission order in the courts, if any, will stem.

It's here that such questions as this will arise: Is an unconnected well a mile away from a common-carrier line in that line's "general area?" How about a well 5 miles away, or 10 miles away, or 30 miles away?

The distance question, the commission thinks, can't be answered with a single arbitrarily set figure. Each case will have to be decided on its merits, taking into consideration such factors as reserves, life of field, and daily production rate.

Reaction to the order . . . Most pipeline attorneys and officials so far are deferring comment on the commission order.

They say they can't be certain yet what the order means due to its general nature. For the most part, they have adopted a wait-and-see attitude pending outcome of the first hearings under the order.

One pipeline-company official said he felt the commission has done "a reasonable and fair job of setting up a measuring stick that anyone should be able to live with."

He described the order as "ground rules whereby a pipeline or producer can have his day in court. It is a common problem and an orderly process has now been set up. If anyone has any problems, he can now get them adjudicated by the commission."

The essence of the order, he believes, is that it permits "judicial review of our management decisions by the commission. These decisions used to be only a management function. With the new order you get into a question of judgment."

His comment on actual impact of the order: "We'll have to find that out from experience."

Independents happy . . . Texas independents on the other hand were openly jubilant.

They launched the drive to force more well connections in February 1957 when five associations joined to file a petition with the commission on the matter (OGJ. Mar. 4, 1957, p. 62).

The resulting series of hearings and brief filings, stretching out for nearly a year (OGJ, Apr. 8, 1957, p. 63; May 20, 1957, p. 110), was concluded with oral arguments by the producers and carriers in Austin January 6 this year

(OGJ, Dec. 23, 1957, p. 39, Jan. 13, 1958, p. 58).

Complainant associations were: Texas Independent Producers and Royalty Owners Association, West Central Texas Oil and Gas Association, East Texas Oil Association, North Texas Oil and Gas Association, and Panhandle Producers and Royalty Owners Association.

The producers responded enthusiastically to the new order despite the fact that it rejected two other sought-after commission actions—one of them an alternative to the order.

The commission declined to order common carriers to expand capacity of their systems, finding that trunk capacity currently is entirely adequate.

It refused also to issue a blanket ruling ordering common carriers to connect all wells in Texas or show cause why not.

A pipeline official said the denial of the request for enlargement of common-carrier lines from West Texas to the Gulf Coast is "recognition of the well-known fact that there is adequate existing capacity. Historically, when the demand has arisen, the lines were built."

Producer reaction to the order actually issued would tend to indicate that they didn't really expect the commission to go so far as to take either of these latter actions.

Eugene M. Locke, president of TIPRO, for instance, termed the order issued "an almost complete victory for independents . . . " He said it "sets forth an entirely proper standard for connecting of wells.

"With imports remaining relatively unrestricted, it had become clear that selective buying in its various forms—including arbitrary denial of pipeline connections—can no longer be prevented simply by reducing allowable days for Texas production. Some more direct action was needed to prevent discrimination.

"The commission, through this order, has given unmistakable evidence that it is going to use its full powers not only to assure equity in connecting wells but in attempting to see that every well and every producer receives a fair share of whatever market exists."

J. S. Lauderdale, president of WCTOGA, in a letter to members of his association, said he believed the order was well worth all the time and expense the association had spent on the pipeline case.

"The significance (of the order) could be far-reaching. And we will watch with much interest its further application to those operators seeking connections."

CLYDE T. FOSTER, left, Standard of Ohio chairman, and Research Manager E. C. Hughes, help dedicate $2,500,000 research center as . . .

Sohio Moves Into New Lab

STANDARD Oil Co. of Ohio has a new ultramodern laboratory at Cleveland in which to continue research on refining processes.

Recent dedication of the research center attracted 370 industrial and business leaders to the 87-acre suburban tract. The new building houses 125 scientists, engineers, and technicians. Before construction of the new center, the company's research activities were carried out for 25 years at or near Western Reserve University and Case Institute of Technology.

Complementing the new setup is a $1-million program, due for completion early in 1959, to expand process and product development and automotive engineering labs adjacent to the company's Cleveland refinery. The program includes new pilot plant space, laboratories, engine test cells, and an all-weather chassis dynamometer.

Past Ohio Standard research has resulted in development of thermal diffusion, microballoons, and the boron additive, for gasoline.

Phillips Going to 25,000 Ft.

PHILLIPS PETROLEUM CO. set casing last week in the world's deepest hole—one that included 11,923 ft. of open hole, also a world mark.

The crew of the 1-EE University in Pecos County, Texas, prepared at week's end to resume drilling to a new projected depth of 25,000 ft.

Drilling had halted at 22,919 ft. for the casing job. This was 349 ft. below the previous depth record of 22,570 ft., set in 1956 in South Louisiana.

Casing was completed in 2 days. It consisted of 7⅝-in. to 10,996 ft., where the open hole began, and then 7-in. for the remaining 11,923 ft.

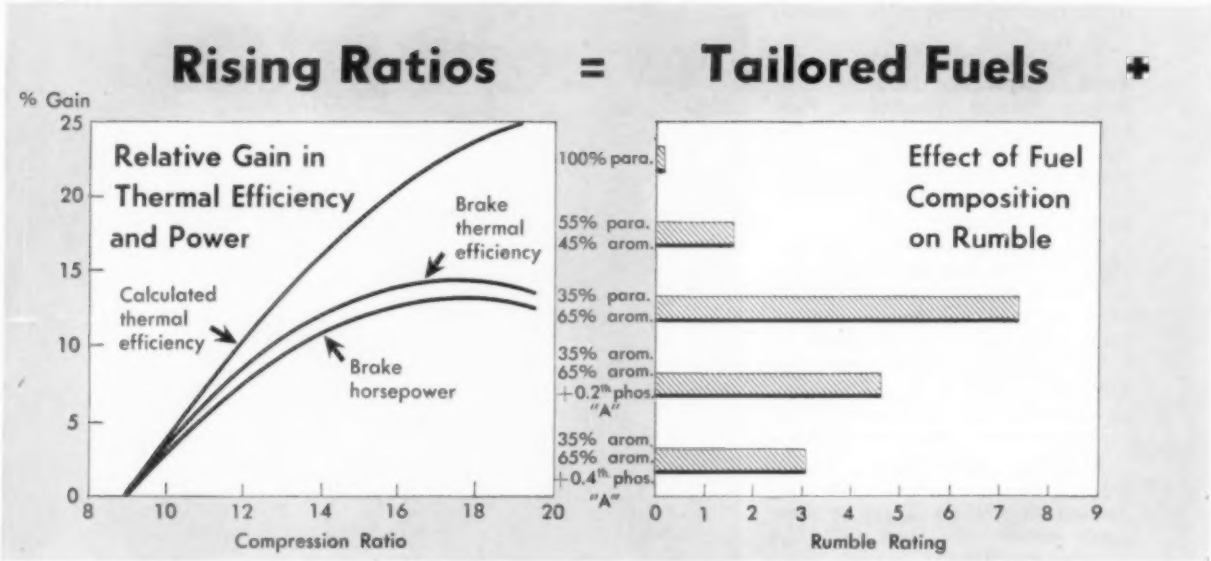
The new hole is 6¼ and will be drilled into the Ellenburger formation, expected between 24,000 and 25,000 ft. When drilling resumed, the hole was in the Simpson.

Phillips hoped to continue making 30 to 60 ft. of hole per day, the same rate it had been making before casing.

Seismograph Service Corp. logged the well to more than 22,800 ft. and reported no difficulties. Two record-depth logging runs were made, one for a geophone survey and the other for interval velocity.

The job was done in 9 hours by SSC's continuous velocity logging crew No. VB under the direction of C. F. Simion.

SSC reported satisfactory performance by the logging equipment at 300° F. and 12,000 psi.



Detroit Is Talking of 17:1 Ratios

• General Motors tells SAE meeting higher octanes are the key to raising compression ratios, but oil researchers say this won't solve all problems. Refining changes must come, but engine design must be improved, too.

IT LOOKS as if the rapid increase in compression ratios of the postwar era is about to slow down. But it also looks as if the end is still a long way off.

One reason the trend will slow down is that compression ratios above 9.5:1 produce problems that have yet to be solved. And indications are that these problems will increase in number and severity as the ratios rise.

Another reason is that the law of diminishing returns is beginning to assert itself. A 0.5 increase in today's average of 9.47:1 is less of an improvement than a half point was on 1953's average of 7.44:1. And, in time, another 0.5 increase on a 12:1 ratio will be much less than the same numerical increase on 1958's 9.47:1 ratio.

It's going to be tougher and slower, but compression ratios will go on increasing. The reason: Maximum efficiency is still far down the road. Two General Motors engineers told last week's SAE meeting in Atlantic City that "thermal efficiency peaks at a compression ratio of 17:1."

Highest requirement U. S. cars today have a compression ratio of 10.5:1, and the 1958 models average 9.47:1. Highest among the foreign cars is Maserati's 12:1.

GM's views . . . GM engineers admit that "gains are approaching a point of diminishing returns." At the same time they contend that a "substantial improvement in the thermal efficiency of modern engines is still possible through increases in compression ratio."

They hang the burden on oil: "The development of these higher compression ratios in commercial engines is dependent on the ability of the petroleum industry to produce economically the higher-octane gasoline."

Oil's answer . . . Linking the solution entirely to octanes is, in the opinion of oil people, a vast oversimplification.

Five oil research teams made it very plain at the same meeting that octanes alone are not the solution. The teams represented Shell Oil Co., Standard Oil Co. (Ohio), Socony Mobil Oil Co., Inc., Ethyl Corp., and Du Pont.

The Socony approach . . . Socony thinks the solution lies in engine design, better oils, and tailored gasoline plus additives. The Socony men put it this way: "If additional increases in compression ratio are to be practical, still further advances must be made in tailoring engines, fuels, and lubricants to function as a perfectly matched ensemble."

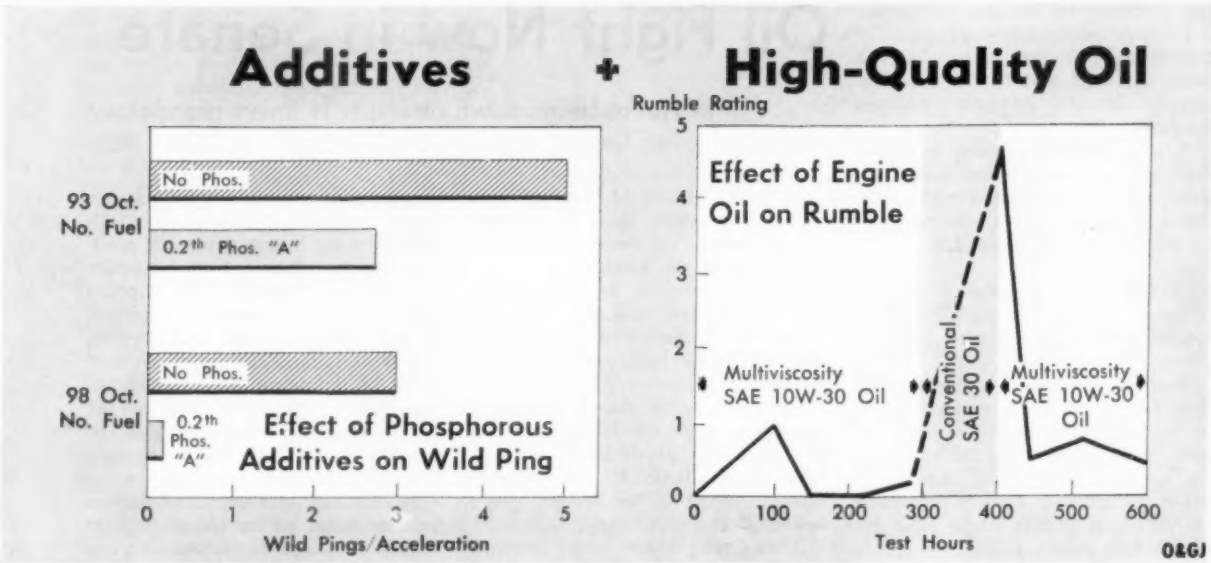
The classic way to attack spark knock is through higher octane fuels, but this is becoming so costly that the method is approaching the point of no return.

Another is engine design, a function outside the scope of oil engineers. A third, and one in the industry's province, is better selection of crankcase oil.

Socony's researchers tested a multiviscosity SAE low-30 engine oil against a conventional SAE 20 product and found that the former cut the research octane requirement a full 2.0 numbers. Then they put together an experimental oil with minimum combustion chamber deposit forming tendencies and compared it with the multiviscosity oil. The method was wholly unrealistic from a commercial standpoint, but it produced an octane requirement another 2.5 octanes below the multiviscosity oil. Apparently that further improvement in engine oils holds a lot of promise.

Wild ping—sharper, clearer, and erratic when compared with spark knock—can be cut down by the combined use of fuels and lubricants designed to minimize it.

Socony ran a 9.5:1 compression ratio V-8 overhead valve engine for the equivalent of 6,000 miles to build up deposits. The requirement to suppress wild ping was 102 octane when



a conventional SAE 20 engine oil and a nonphosphorous fuel were used.

Changing the oil to a multiviscosity SAE 10-W-30 oil reduced the requirement to 99.6. When a fuel with 0.2th phosphorus "A" added was used with the multiviscosity oil, the requirement dropped to 97.4 octane. Socony called this, and rightly so, a dramatic illustration of the advantage to be gained by the combined use of fuels and lubricants designed to minimize wild ping.

Eliminating rumble . . . Socony's men think that rumble might be corrected by stronger structural design of the lower engine areas.

Refiners might help solve the problem controlling hydrocarbon types in the fuel and, once again, using better engine oils.

They found that fuel hydrocarbon types do affect rumble. A 100% paraffinic fuel caused no rumble; a 55% paraffinic-45% aromatic fuel had a rumble rating of 1.6, and a 35% paraffinic-65% aromatic fuel had a rating of 7.4. They found that this severe rating can be knocked down by the addition of phosphorus additive "A."

They found, too, that the proper oil helps on rumble as well as on wild ping. A paraffinic fueled engine lubricated with an SAE 10-W-30 oil had a rumble rating of 0 to 1. It jumped to 2.3 when the multiviscosity oil was replaced with a conventional SAE 30 grade and gradually rose to 4.7. When the conventional oil was replaced with the multiviscosity again, the rating dropped back to 0.5.

As far as hot spot surface ignition is concerned, the Socony men feel that, first of all, spark plugs must be designed to handle the higher heat loads of greater horsepower and higher compression engines. It will then be oil's job to provide fuels and lubricants with better antifouling properties.

Phosphorus "A" could be part of the answer. In one of the tests, plugs became so fouled in 1,000 miles that the time of acceleration from 10 to 60 miles had increased 60%. In another test with the same fuel, but with 0.2th phosphorus "A" added, the increase in acceleration time was only 15%.

What Ethyl found . . . Ethyl's engineers reported that aromatics are conducive to rumble but that volatile olefins are the worst offenders. This would prove that rumble is a problem that higher octanes won't cure. Furthermore, the Ethyl men believe that the type of combustion chamber doesn't affect rumble nor do they believe that more rigid engines would correct it.

This tends to put the problem squarely in the lap of the refiner. At present, however, refiners are tending toward fuels of greater aromatic content which will intensify rather than relieve the problem. An obvious solution is to emphasize highly paraffinic fuels, but economics are a deterring factor. Ethyl concludes that, while they are not a complete cure, phosphorus additives do a good job of reducing rumble.

One of the Ethyl tests compared two fuels with the same aromatic content. Fuel A, however, had about 45% more aromatics in the 338° F. and higher fraction than Fuel B. There was more rumble with Fuel A which clearly showed that higher boiling aromatics are undesirable.

Another test compared an alkylate (0% aromatics) with a catalytic reformate (45% aromatics). The test engine was operated on the highly aromatic fuel until deposits stabilized. After that, rumble occurred 100% of the time with highly aromatic commercial type fuels and 89% of the time with a highly aromatic 105 octane reference fuel. There was no rumble with the alkylate.

A third Ethyl test found that, with 0.4 theory of phosphorus additive, the incidence of rumble was reduced from 46 to 18%. I showed that while phosphorous fuel additives are not a complete corrective, they are highly effective in reducing rumble.

Volatile olefins seem to be the real bad actors—worse than higher boiling aromatics.

Ethyl blended test fuels of highly olefinic catalytic naphtha and highly aromatic catalytic reformate. When the blend was changed from 30% naphtha-70% catalytic reformate to 65% naphtha-35% cat reformate, it caused the relative surface ignition rate to increase from 100 to 168%.

Shell's report . . . Shell's researchers found that tricresyl phosphate can eliminate rumble, which they call "pounding," in 1958 and earlier model engines. But, like the Ethyl engineers, they found that a phosphorus additive will not do the trick in engines of the future.

While the Ethyl people feel that combustion chamber design won't affect the problem, the Shell men list "poor combustion chamber shape" as the first of three factors which tend to promote pounding. The others are the use of rapid-burning fuels and deposit ignition, both of which are in

the realm of oil industry problems.

Tricresyl phosphate is effective in controlling pounding today, but at ratios of 11.9:1 and 12.5:1 it is only partially effective at present concentrations.

"Unless engine designers can provide help as compression ratios are increased, further improvement in the chemical control of pounding may be needed," Shell contended.

Sohio's story . . . Standard Oil Co. (Ohio) also found that paraffinic fuels reduce rumble and aromatic fuels increase it.

But they found even a 100% paraffinic fuel is not the complete answer in the higher compression ratio engines that are coming. As ratios go up, so does the rumble tendency of the paraffinic fuel. They rumble rated such fuels at 0 in a 10.5:1 ratio engine but at 2.0 in a 12:1.

They added two deposit-modifying additives to gasoline and found a market reduction in rumble tendency. One reduced rumble incidence from 94 to 54% and the other to 44%. Together they reduced it to 25%.

The Sohio authors believed that much of the responsibility for the prevention of rumble lies with the automobile manufacturer. He can, they said, minimize rumble by proper selection of compression ratio, air-fuel ratio, thermostats, spark advance and spark plug heat range. The last point agrees with the strong Socony emphasis on spark plugs.

Du Pont's findings . . . The Du Pont team discussed still another term—thud—which had previously been referred to as "roughness" or "harshness."

Thud also is a low-pitched engine noise caused by high rates of pressure rise. It differs from rumble in this respect: The high rate of pressure rise causing rumble is attributed to the formation of additional flame fronts by surface ignition from combustion chamber deposits. The high rate of pressure rise causing thud, however, is attributed to rapid but orderly combustion of fuel at a high rate without the accelerating effect of surface ignition.

The increasing number and growing severity of problems caused by high-compression engines add up to a tough nut to crack. It's tough, and it's important.

Socony's team capsuled the situation with this remark: "If hot spot surface ignition is not prevented, the motorist won't have to decide whether the knock he hears is spark knock, wild ping or rumble. His engine won't be operating long enough to matter."

Oil Fight Now in Senate

. . . after House beats down attempts to insert mandatory control over imports into revised Reciprocal Trade Act.

THE RECIPROCAL TRADE bill, with an expanded national security clause, heads this week toward a tough fight in the Senate.

The bill survived the first of its two big tests last week. It passed the House by better than 4-to-1 vote after an 8-hour fight over control of oil imports.

But much of the success in getting the bill through the House was due to a gag rule which barred amendment on the floor. It will not have that advantage in the Senate, where neither debate nor change is limited.

The final House vote climaxed several weeks of behind-the-scenes efforts of Democratic leaders and the White House to line up support to fend off mandatory controls on oil imports.

The first move to be knocked off was the Ikard plan to put quotas on oil imports and sell import certificates to the highest bidders.

A substitute bill backed by a bloc headed by Rep. Richard M. Simpson (R-Ohio) was harder to kill. Members finally agreed to let it come on the floor for vote.

In the showdown, however, support for the administration measure steadily increased. The motion to substitute the Simpson bill was defeated, 234 to 147. The House then rejected a move to recommit the bill to committee, 268 to 146, and finally passed the bill by a vote of 317 to 98.

What it does . . . The bill, as it came out of the house:

. . . **Spells out in detail** the factors other than volume that are to be taken into account in deciding whether imports threaten national security.

. . . **Permits an investigation** by the Office of Defense Mobilization on the request of any interested party or the head of a government agency. The findings of the mobilization director are to be reported to the President for action. This will eliminate the double investigation by ODM and the President called for by the present law.

The bill requires that the mobilization director and the President "shall in the light of the requirements of national security and without excluding other relevant factors give consideration to domestic production needed for projected national-defense requirements existing and anticipated, availabilities of the human resources, products, raw materials, and other supplies and services essential to the national defense, the requirements of growth of such industries and such supplies and services, and the importation of goods in terms of their quantities, availabilities, character, and use as those effect such industries and the capacity of the United States to meet national security requirements."

At the last minute, these factors were extended on the House floor to include the need for investment, exploration, and development.

Changes explained . . . Prior to the voting on the bill, Chairman Wilbur D. Mills (D-Ark.) of the ways and means committee answered questions as to the intent of the rewritten Section 7.

The purpose of the section, Mills said, is to avoid a threat to our national security through imports and to make sure that injury to an industry essential to defense will be avoided.

The new wording is aimed at improving and facilitating the operation of this provision by providing specific criteria and guidelines for its administration.

Questioned by Ikard, who later announced his support of the bill, Mills agreed that the intent of the section is to hold imports of crude and products at levels which would permit the domestic industry to engage in vigorous program of exploration at a rate consistent with the demands of our economy.

The inclusion of investment, exploration, and development as factors to be considered is intended to make sure that the industry can do this, Mills said.

"If drilling and exploration activities do not reach a satisfactory level, then under this provision the President or his designate would have the responsibility of reevaluating existing programs for the regulation and control of imports to see that they meet the requirements of the new standards," he explained.

Mills also agreed that control of oil imports should take into consideration "products, derivatives, or residues of petroleum" so that they could not circumvent crude controls.

"Clearly, when a decision is taken

to restrict imports in the interest of national security, it is our intention that the decision be effective and not rendered ineffective by circumvention," he declared.

The rewriting of the provision will not make a new investigation of oil imports necessary. Section 7 is so worded as to make that clear, Mills said.

Comes up quickly . . . The bill is expected to be taken up promptly by the Senate.

Only 2 weeks remain for passage of the measure before the present law expires June 30.

An all-out fight for mandatory oil controls is expected to erupt both in the finance committee and on the Senate floor. But the committee is expected to send the bill along to the Senate as quickly as possible.

Import Ban Tested

by Eastern States. Jet-fuel military contract at stake.

AN IMPORTANT test of the executive order denying government oil contracts to violators of crude-import quotas has been raised by Eastern States Petroleum & Chemical Corp.

At stake is a contract for 12 million gallons of jet fuel awarded by the Military Petroleum Supply Agency on the basis of bids opened May 14. At issue is the question whether the executive order can be applied retroactively.

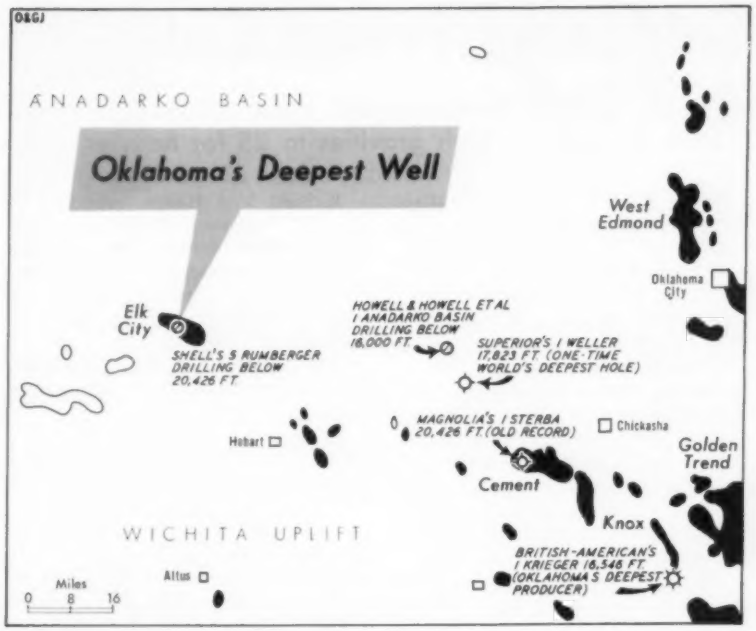
The order barred awards to bidders whose imports over the 3 months prior to bidding had exceeded their quota—if the product offered was made from such "noncomplying" oil.

Capt. M. V. Carson, Jr., import administrator, advised the MPSA early this month that Eastern States had not been in compliance with the program over the 3 months prior to the May 14 bid.

Eastern States appealed Carson's ruling to Interior Sec. Fred A. Seaton. Seaton said responsibility for carrying out the order lies with the Defense Department.

The company asserted that it was in compliance with the import program from the effective date of the executive order until May 14, at least. It challenged the legality of retroactively applying a punitive measure.

At the same time, the company contended it was entitled to a review of its allocation. It has said it could not get down to its quota because of contractural difficulties.



Sooner Wildcat Sets Record

OKLAHOMA has a new drilling depth record for the second time in less than a year.

Shell Oil Co., in an attempt to find out what lies at the bottom of the big Anadarko basin, was drilling below 20,430 ft. at the 5 Rumberger in Elk City field, Beckham County.

This is deeper than Magnolia Petroleum Co.'s 1 Sterba-Ordovician in Cement field, Caddo County, which set a new state drilling-depth record at 20,426 ft. last summer (OGJ, July 22, p. 55, and Sept. 30, p. 68).

Gas shows . . . Using Helmerich & Payne's heaviest rig, the Shell record-holder found gas shows at 20,097-20,102 ft. in the Morrow-Pennsylvanian.

Later, the operator lost circulation. After several days of regaining circulation, 7-in. liner was set at 20,104 ft. Then the deep test continued into the thick Morrow sand and shale section. Objective is the Springer sand.

The well was spudded last July. One interesting feature of the 12¼-in. hole was the experimental run of Dresser Industries' Russian-made turbodrill.

Deep basin . . . Shell's well and the Magnolia test at Cement are both in the seemingly bottomless Anadarko basin, which is one of the nation's biggest and least-tested oil provinces.

Most production in the multistate basin is in the southeast corner, on the northwestern shelves, and along the Amarillo-Wichita Mountain uplift front. The ultradeep center still awaits the drill.

Oklahoma's deepest production is in the extreme southeast corner of the basin at Knox field, where deep Ordovician rocks were tapped 2 years ago. The deepest producer is British-American Oil Producing Co.'s 1 Krieger in Stephens County, a gas-condensate well in the Oil Creek sand at 16,526-46 ft.

Several other Knox wells produce below the 16,000-ft. mark. Production in the field is prolific, pay sands are thick, and future drilling is very promising. Outside of South Louisiana, Knox drilling is the deepest oil and gas hunt under way in the nation.

The Howell test . . . Another important wildcat in the basin is the Howell & Howell et al. 1 Anadarko Basin in Caddo County.

This well is drilling below 16,000 ft. and is running high to the deep Superior Oil Co. 1 Weller.

Operators at the 1 Anadarko logged about 190 ft. of Morrow zone. The well tried to blow out at 15,415 ft. Sand was found at 15,155-15,355 ft. on a log run. The Springer (Pennsylvanian) was topped at 15,485 ft. Gas showed below 16,000 ft.

This well was first planned as a 24,000-ft. Simpson (Ordovician) test. If it continues to run high structurally, the Bromide may be found above this.

California Prices Cut

. . . by General Petroleum and Union. Reductions range from 10 cents on high gravities to 25 for heavier ones.

TWO MAJOR California crude buyers have cut West Coast prices from 10 to 25 cents a barrel.

If the new postings stick, they will represent the second major crude price reduction for California this year.

General Petroleum Corp. led off by posting new prices effective June 9 providing cuts ranging from 25 cents a barrel for low-gravity oil to 10 cents a barrel for higher gravities.

Union Oil Co. of California met the cuts with lower postings. Other major buyers studied their positions but withheld action.

Typical of the new price cuts are those posted for Signal Hill field. Oil of 16-16.9° gravity was cut 21 cents —from $2.58 a barrel to $2.37. The 37-37.9°-gravity oil was dropped 12 cents—from $3.68 to $3.56 a barrel.

Only 8 weeks ago California buyers posted cuts only on the lower gravities. The reductions ranged up to 14 cents but left crude above 26° gravity unchanged. The reductions last week again penalized the heavy crudes most but affected the entire scale.

The heavier crudes, however, still are in a better relative position than the lighter ones. They are priced 24 cents higher than they were 2 years ago, while light crudes have gained only 13 cents in the same period. During that time buyers raised prices twice and cut twice.

Fuel oil hurting . . . The new postings are closely tied to the present depressed state of the fuel-oil market.

Demand for fuel oil currently is running nearly 100,000 bbl. daily behind a year ago. This slack is being blamed on these factors:

. . . **Natural gas** has replaced the equivalent of about 60,000 bbl. daily of fuel oil since last year.

. . . **An abnormally warm winter** cut down heating needs.

. . . **The wettest winter** in many years provided plenty of rainfall for hydroelectric plants to use in electric generation. Ordinarily, a large part of this hydroelectric-generated power would be met by steam-generating plants, using fuel oils.

Producers protest . . . Reaction of small oil producers was immediate.

Richard Von Hagen, president of the Oil Producers Agency of California, which represents many of the producers, protested the new postings. He asked General Petroleum to rescind the action and asked the other majors not to follow.

Von Hagen blamed California's current oversupply condition on imports.

General Petroleum's President Robert L. Minckler, however, in a prepared statement denied imports are to blame. He declared:

"The level of crude-oil imports has had practically no effect on heavy fuel-oil supply because the crude oil imported has a very low fuel-oil content, probably no more in aggregate that the fuel-oil requirements of the tankers bringing in the crude oil."

A study of California's crude production reveals a significant change has taken place in the last 7 years in the ratio of heavy crudes produced to light crudes.

In 1951, California heavy-crude production (20° gravity or less) amounted to 244,055 bbl. daily, or 26% of the state's total. Last year, heavy-crude production was 279,502 bbl. daily, or 30.5% of the state's production.

In the same periods, 1951 and 1957, light-crude production showed an opposite trend. In 1951, light-crude production averaged 684,937 bbl. daily. Last year it had dropped to 637,715 bbl. daily.

Cuts in Texas . . . A 10-cent price cut was posted by Sinclair Crude Oil Co. in two areas along the Texas Gulf Coast.

Sinclair's new prices provide a $2.93 a barrel top for Southeast Texas-type crude in Brazoria, Hardin, and Wharton counties; and the same top for Coastal-grade crude in Boling and Damon Mound fields of Wharton and Brazoria counties.

The cuts involved a total of about 19,000 bbl. daily and were described as adjustments to meet prices of competitive crudes.

New Imports Order Confusing

CAPT. M. V. Carson, Jr., import administrator, has had a tough problem dropped in his lap by the cabinet fuels committee.

Before he can work out quotas for importers of unfinished oils, Carson must decide just what they are.

Unfinished oils have lain for years in a twilight zone in both industry and government figuring. All unfinished products are lumped into two categories—topped crude and unfinished oils for further processing.

Until recently there was no worry about these imports. Now that they are to be controlled, it appears that there are several definitions of the term "unfinished oils."

The Customs Bureau has one definition. The Bureau of Mines has another. And Washington officials say the API has still a third.

Carson is seeking a clear definition that will leave no doubt about what is covered by the new import controls (OGJ, June 9, p. 64).

Topped crude is a good instance of what he is up against. It might be brought in as residual fuel oil, considered a finished product. But it can be used to make asphalt or for blending, putting it in the class of unfinished oils.

The upshot might be the classification of such imports according to the use to which they will be put.

This would be new to the oil industry. But it would not be new so far as import tariff schedules are concerned. A number of items get different treatment according to whether they are to be consumed in the shape imported or used "for further manufacturing."

Current level puzzling . . . Once he has defined the imports to be controlled, Carson must find "the currently prevailing level" to which they must be held under the cabinet committee order.

Census Bureau import figures are not broken down fine enough for this purpose. Many companies submit some figures in their monthly reports on imports, but not all. The Bureau of Mines gets reports also from the companies, but they are about 10% short of complete.

There is also some question about what the committee meant in the use of the word "currently." Asst. Commerce Sec. Frederick H. Mueller suggested it might be the January-May average. But Carson will have to figure it out.

After these and some other questions are solved, Carson will set the over-all recommended level of imports and assign quotas to the individual importers.

No hearings will be held in advance of the assignments.

Texans Get Warning

from Thompson not to jump crude production too fast.

A WARNING not to be too optimistic over the steady drain on stocks has been handed the oil industry by E. O. Thompson, veteran member of the Texas Railroad Commission.

Speaking with Texas' July allowable hearing just around the corner, Thompson warned that hiking production too much too soon could undo all the progress toward recovery the industry has made so painfully since the post-Suez bust in demand.

By reducing producing days from 18 in March 1957 to the current level of only 8, Texas gradually has been able again to attain a ratable market for all operators. Many still have to truck their oil at great cost, however.

"It is of the great importance that the improvement in crude-oil inventories be carefully studied by all concerned," Thompson said. "There is no wisdom in plunging our Texas oil industry into overproduction again just because stocks have been reduced appreciably. They are still higher than the testimony as to adequate levels given us (by company officials) in March. There is no point in producing more oil than can be sold ratably by all producers in the state."

Thompson pointed out that the company-desired level of crude stocks as of April 1 this year was 257,600,000 bbl. and the desired total of crude and product stocks was 563,000,000 bbl. Crude stocks currently total 268,800,000 bbl. and total stocks 632,900,000 bbl., he said.

The plain-talking commissioner fired a shot at major oil companies in his statement. He said he expected major purchasers to back greatly increased allowables at the upcoming July allowable hearing June 17. "They want this in order to permit them to take greater amounts of oil from their own wells and connections instead of having to buy oil in the open market.

"This is only natural. But if the allowable is set too high, then purchaser proration is resorted to by these very oil buyers. The aim is to give all producers a fair ratable market. That's the market-demand law."

watching WASHINGTON

. . . with Bertram F. Linz

• Imports showdown shifts to Senate

DOMESTIC oil producers haven't given up their fight for import quotas. But they are down now to one last-chance effort in the Senate.

A couple of times in the past, the Senate has come pretty close to putting import curbs into the foreign trade act.

An amendment to that end was narrowly defeated in 1950. And 3 years ago the pressure for the Neely amendment brought the administration's offer of the national security clause which is under attack now.

A number of senators have put themselves on record as favoring mandatory controls. They will spearhead the drive when the trade bill comes up. But whether they can attract enough support to put quotas over is a question.

If the Senate should write stiff imports control into the bill, it would still have to get the approval of a conference committee. That would seem to be a 50-50 chance, since normally each house has the same number of conferees. But actually, much depends on the views of the men who make up the committee.

And finally, if quotas should be voted by the Senate and retained by the conference committee, each house will still have to vote on whether to accept the conference report.

• Exit Wolverton, Heselton, and O'Hara

TIME is catching up with the men who, over the years, have helped make oil history in Congress.

Already, because of age, poor health, or other reasons, 36 Senate and House members have decided not to run for reelection this year.

Among the group are 3 senators and 10 congressmen who voted for the original Harris gas bill in 1955.

This, the biggest voluntary exodus in recent years, will include men holding high-ranking committee seats. Thus, three top Republican chairs in the House commerce committee will be left vacant by Reps. Charles A. Wolverton (N.J.), Joseph P. O'Hara (Minn.) and John W. Heselton (Mass.), who have played important roles in natural gas and oil matters.

Only six of the men who are retiring are Democrats. Three of them are quitting to run for the Senate, among them Rep. Clair Engle (Calif.) who last year won his battle against military grabs of oil-bearing lands.

However, only 6 of the 30 retiring Republicans are running for other offices.

• Door still open to king-size mergers

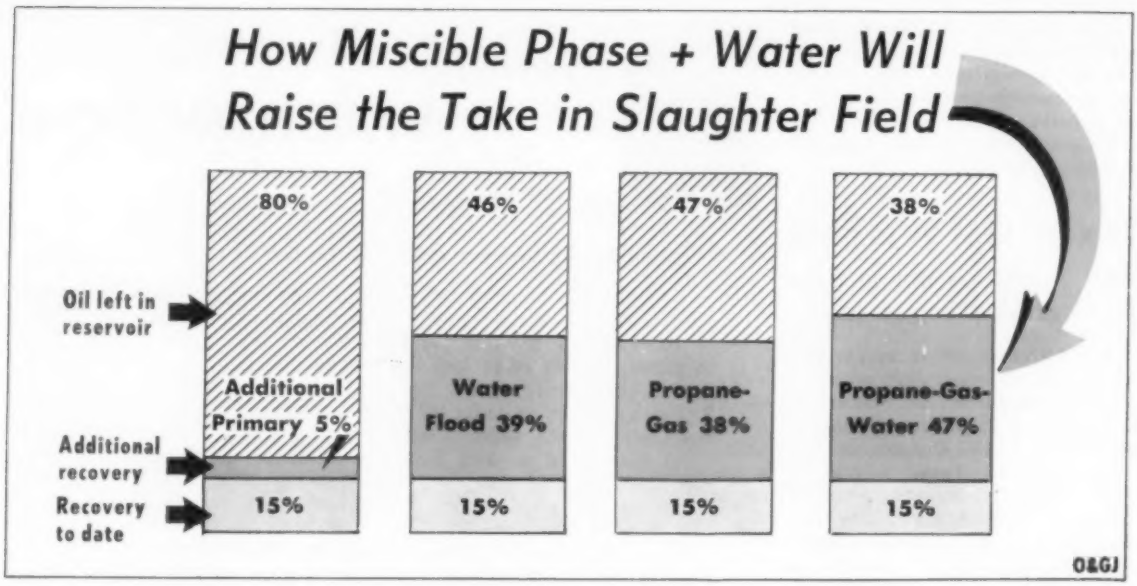
THE Federal Trade Commission has given business a reassuring pat on the back.

A merger of companies which between them hold 50% of the market for a product doesn't automatically lessen competition in violation of the antitrust laws, the FTC holds.

But on the other hand, it says, the fact that a merger affects only a small percentage of the market doesn't necessarily mean that the antimerger section of the Clayton Act hasn't been violated.

Size is only one of the factors that decide the legality of a merger, it is explained. The general competitive situation, number of competitors, and degree of concentration prevailing in the industry also must be analyzed.

This small consolation for big business isn't going to sit well in all quarters. Many congressmen and lawyers have long argued that any merger which gives one company the lion's share of the market just can't be legal. Eventually, the courts will have to decide who's right.



Slaughter Project Will Test New Idea

A SHUTTLING SWARM of propane tank trucks in West Texas' big Slaughter field has signaled the kickoff of one of the most advanced secondary-recovery projects yet.

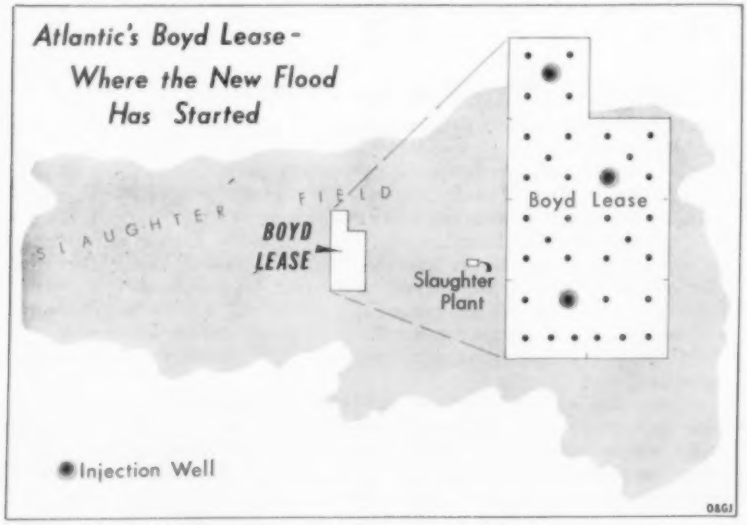
The operation, which carries the LPG-slug version of the miscible-phase type drive a step further, is being pushed ahead by Atlantic Refining Co. on its 1,247-acre H. T. Boyd lease (see map).

Atlantic, which pioneered the industry's first actual miscible drive with its Block 31 Devonian high-pressure gas project, will inject first propane, then gas, then water into the San Andres pay at Slaughter.

The water will improve what Atlantic feels would be a poor areal sweep efficiency using the propane-slug drive alone.

The Boyd lease has now produced about 5,000,000 bbl., which Atlantic figures is about 15% of oil in place. This fixes oil in place at about 34,000,000 bbl. initially. The company thinks it could get a maximum of only about 5% more oil if primary operations were continued.

Atlantic expects the current Boyd project, however, to bring in an added 47% of in-place oil, or roughly 16,000,000 bbl. This would boost total oil take to 62% of that originally under the lease.



Boyd timetable . . . Atlantic now is well along with injection of the propane slug.

It started injection May 9 and expects to pump in the last of the 253,000-bbl. slug late in June. The three input wells involved in the program are swallowing the propane currently at an average rate of about 6,000 bbl. daily.

When the reservoir has taken all the propane, Atlantic will start injecting gas through the same three wells at a total daily rate of about 3,500,000 cu. ft.

The company will continue the gas phase for 2½ to 3 years and inject during that time roughly 3.4 billion cubic feet.

Then it will change over to water. Water volume injected will run around 6,000 bbl. daily, still through the same three input wells.

Lapse back to flood . . . Propane input pressure at the two southernmost injection wells (see map) is being maintained at about 1,200 psi. It is averaging only about 150 psi. at the north input, where the producing area is smaller.

Atlantic technicians are keeping close tab on pressure and injectivity of the input wells. This will give them better figures on San Andres permeability in the area and enable them to fix more exactly the gas pressure which the company must maintain later to insure miscibility at the gas-propane interface.

The engineers figure now that the interface pressure must be held at

about 1,300 psi. This means a surface injection pressure of about 2,000 psi.

Bottom-hole pressure in the general area of Slaughter in and around the Boyd lease now is down to about 640 psi. Raising pressure to get the miscible effect under the Boyd lease means that oil will be forced toward lease lines. And eventually the oil would begin to migrate in substantial quantities across the lines to adjoining leases where the low pressures would still prevail.

Atlantic engineers calculate the company can maintain a miscible front only until it has swept 35 to 40% of the pay before oil losses across the lease lines will become too great.

When that point is reached, the company plans to let the pressure drop back to a level comparable to that of neighboring leases and carry on with a conventional water flood.

If the Boyd lease were a sealed reservoir, with migration across lease lines not a factor, Atlantic figures total oil recovery could be much higher, perhaps close to 90% of that originally in place.

Importance of the water . . . Without following the propane and gas with water, Atlantic engineers feel, recovery from the Boyd project would be no better, and possibly less, than with a water flood alone.

The company says its technicians have not yet been able to find a reservoir where a propane-gas slug drive alone would be economically feasible in comparison with a common water flood because of the former's inefficient areal sweep.

This simply means that, though the miscible slug will sweep clean wherever it reaches, Atlantic feels it won't reach a large portion of the reservoir rock. Conversely, water contacts most of the reservoir rock but leaves much oil behind.

Ideally, Atlantic figures, water and gas should be injected simultaneously behind the gas band to get the most oil out. This wasn't considered feasible at the Boyd project because of the migration problem.

Where it is possible, such dual fluid injection would improve the slug drive's sweep in two ways by:

. . . **Lowering** the pay zone's relative permeability to gas by interfering with the gas flow, and

. . . **Increasing** the average viscosity of the flowing system pushing the oil (OGJ, July 15, 1957, p. 59).

Water alone, however, will greatly increase the system's sweep.

Slaughter a good prospect . . . Atlantic considers the San Andres underlying the Boyd lease and Slaughter field generally an excellent prospect for the miscible-drive type of recovery project.

Not many artificial drives of any kind are yet operating in the huge 83,500-acre field. And those already installed are small.

But field pressure is low and dropping. More and more Slaughter acreage will undergo some form of pressure maintenance. And eventually Atlantic expects to see the entire field producing in this manner—probably via both units and cooperative projects using both water flood and miscible-phase techniques.

The stake in added oil is big, very big. Some idea is provided in an Atlantic calculation extending expected results of its 35-well Boyd project to a hypothetical operation of the same type throughout the 2,530-well West Texas giant. The answer: More than a billion barrels of added Slaughter oil.

Finding LPG Can Be Tough

ATLANTIC has had to whip some monumental logistics problems in getting its Boyd project going.

One was to find the propane.

The company's gas department labored over this one for several months. You don't often find 253,000 bbl. of propane available in West Texas in one spot.

Atlantic finally rounded up the required volume at nine gasoline plants scattered over West Texas.

Propane for injection at the Boyd lease is coming from the Slaughter, Levelland, and Lehman plants in Cochran County, the Block 31 Devonian plant in Crane County, the North Synder plant in Scurry County, the South Fullerton and Three Bar plants in Andrews County, the North Cowden plant in Ector County, and the West Seminole plant in Gaines County.

Transportation . . . A second headache is getting the propane to the lease when it is needed.

The company called in Ferguson & Steere, a trucking service firm, to help with this one. The trucking firm now has 25 tank trucks, with an average capacity of about 170 bbl. each, working 24 hours a day hauling in the propane.

The actual injection operation is being handled by still another service firm, R. J. Allison Co., Tulsa, under a contract from Atlantic.

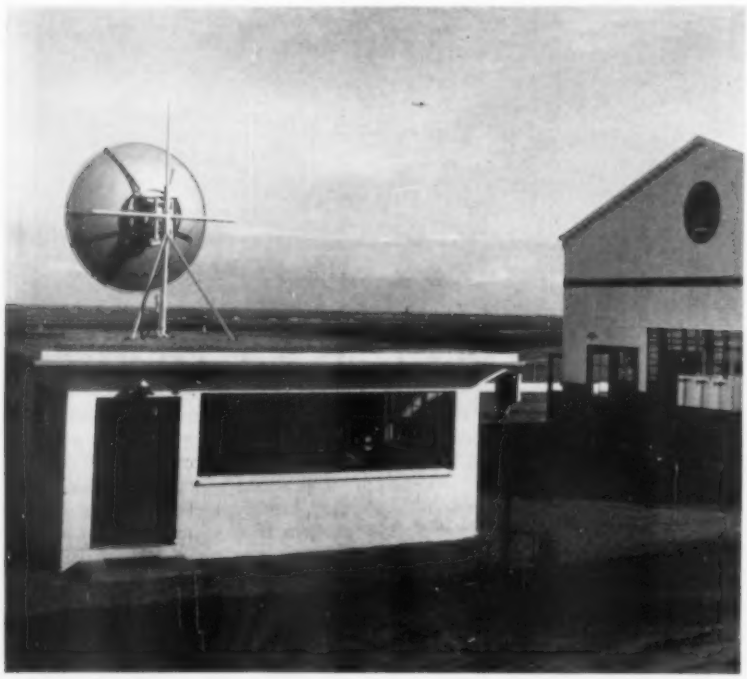
Tank trucks unload propane into surge tanks on the Boyd lease (photo). Four high-pressure pumps take the product from the tanks and from the Slaughter plant through a 4-mile, 4-in. line and discharge it at 1,200 psi. into a header and then into the high-pressure distribution system to the input wells.

The gas changeover . . . When all propane is injected later this month, Atlantic will switch over immediately to gas.

Gas will come to the lease from the Slaughter plant through the same line now moving propane.

Roughly 2,000,000 cu. ft. of the 3,350,000 cu. ft. of gas slated for daily injection is Atlantic's own gas, produced on the Boyd lease. This gas will be processed and returned to the company by the Slaughter plant. Atlantic must buy the remainder.

Communications System Saves Money



THIS UNATTENDED pump station is run by remote control on Union's microwave system. It's the Patterson station in San Joaquin Valley.

AND THIS is the instrument panel inside the pump station. It's part of Union's complete company-owned and operated communications system.

Union Oil is using both microwave and wire lines to connect the company's widespread operations.

UNION OIL CO., which recently moved into a new headquarters building in Los Angeles, has now completed what is probably the industry's most comprehensive integrated company communications system.

The system has these major features:

. . . **A microwave** for long distance calls between major company operating areas.

. . . **A wire line carrier system,** also for long distance calls, used mostly in the coastal and San Joaquin Valley divisions. Plans are in progress to change portions of this system to microwave within 2 years.

. . . **A private 700-line** automatic exchange system in the main building, where traffic averages 4,600 calls an hour, and eight other private automatic dial exchanges and four manual switchboards.

With some exceptions, the setup permits any Union employe to call any other Union employe virtually anywhere in California without going through a public phone system. This includes calls to mobile units, rigs, tankers, refineries, and remote pipeline stations, as well as calls between major company operating areas.

Long distance calls . . . The long distance facilities—microwave and wire line carriers—consist of 22 microwave stations with 66 transmitters. The system can handle 120 simultaneous long distance conversations.

At one point in the flat San Joaquin Valley, Union was able to space two repeaters used in the chain to link the San Francisco Bay region and Los Angeles, 86.6 miles apart.

More than 700 direct dial long distance calls are made daily by Union between Los Angeles and San Francisco areas. Calls to other areas in the system exceed 600 a day.

The microwave system provides more than 11,000 channel miles of long distance circuits.

The wire line system has more than 2,000 channel miles of long distance circuits.

In all, Union's system services 3,100

phones used by more than half the company's 8,000 employes.

Not just for phones . . . In addition to the phone conversations handled, the system is also used for:

. . . Pipeline dispatching.

. . . A special teletype setup between Los Angeles and San Francisco for printed report transmission.

. . . Telemetering pipeline and field information.

. . . Transmitting punch card information for data processing in Union's main computing and data processing center in Los Angeles.

. . . Inventory control.

. . . A letter-writing setup whereby a Union employe can dial a certain number and dictate letters. This eliminates the need for a large number of dictating machines because it requires only one dictating machine for every 10 to 14 persons ordinarily using such equipment.

Union's private phone company is handled by 22 employes, including supervisory personnel. Of these, 17 are maintenance-repair men. The microwave system maintenance is handled under contract with R.C.A. Local radio repair services are used for the mobile equipment.

The communications department is under J. H. Robinson, manager of pipelines and communications. Directly responsible for the system under Robinson is E. W. Messenger, senior communications engineer.

Electronic trickery . . . Union's system employs several unique electronic feats.

In one case, Union achieved a 90° bend in the microwave beam by a novel back-to-back arrangement of two antennae.

In another case, Union was unable to get the microwave beam directly from a mountain top to an unattended pump station hidden at the bottom of the mountain. The company solved this problem by erecting a large-sized metal backboard on the flatland in front of the station and banked the microwave beam 180° back to the station.

Advantages . . . Why such an elaborate system?

Two reasons, says Union:

. . . Most important, an integrated oil company's operations are too critical, where time is paramount, to trust entirely to public service.

. . . It's cheaper.

Union's entire company-owned and operated communications system cost in the neighborhood of $3 million. But if satisfied looks mean anything, the payout factor must be very favorable.

Price-Fix Case Slow Starting

THE GOVERNMENT'S biggest case against the oil industry in 20 years has yet to get off the ground.

The 29 companies indicted on a criminal charge of price-fixing (OGJ, June 9, p. 68) were due for arraignment before Judge Albert Bryan in the Alexandria, Va., federal District Court last week.

Attorneys for the companies showed up, but after some legal maneuvering the entering of pleas of innocence by 26 of them was put off for at least 3 months.

Three of the indicted concerns—Cities Service Co., Cities Service Oil Co., and Arkansas Fuel Oil Corp.—jumped the gun and pleaded not guilty the previous weekend.

No officials of any of the companies showed up. Their pleas were to have been offered by lawyers, more than 50 of whom were in the courtroom. Observers figure that since each of the companies will present its own defense, as many as 100 attorneys may be required.

An oil company official estimated it will cost each of the defendants anywhere up to $1.5 million before a final verdict is handed down.

Dates are set . . . The only concrete result of the hour-long session before Judge Bryan was a short-term timetable.

Judge Bryan set July 10 as the date for argument on a government motion to impound all the records turned over to the special grand jury which indicted the companies.

He ruled the Justice Department could retain the records until that date, despite protests by defense lawyers that they contained trade secrets and that many of them were old documents with no bearing on the case.

The court also gave the companies until August 1 to file the motions that must precede arraignment. The companies are expected to attack the make-up and conduct of the grand jury and may ask for bills of particulars.

A preliminary conference will be held August 10, at which time Judge Bryan may extend the period for these filings if they have not been completed. The companies asked for 90 days to write their briefs but got about half that time.

Judge Bryan will take the case up again September 10 to set a new date for possible arraignment.

The lawyers . . . The Justice Department was represented at the hearing by Joseph E. McDowell, chief prosecutor in the case, Gordon B. Spivack, Harry Cladoukos, John E. McDermott, and Theodore F. Craver.

The companies were represented by what one official described as "probably the largest gathering of high-priced legal brains in the country."

Few Engineers Joining Unions

UNIONS represent about 1,400 professional engineers and scientists in the oil industry.

About 40,000 scientific employes in U.S. industry as a whole are represented by unions and 30,000 of these are dues-paying members.

These facts were presented in a special study by a committee of the National Society of Professional Engineers. It is the first tabulation of its kind for engineers.

Wayne E. Ault, chairman of the study committee, said the statistical material is intended to help professional engineers and scientists evaluate the facts in the controversial "unionization" question.

Pointing out the society is firmly opposed to unionization of professional engineers, Ault said this fact has not influenced the compilation of engineer-technician unions.

The tabulation includes 28 collective bargaining units of unions representing engineers, scientists, and technicians. The units are limited to those in which the professional or technician element is predominant. It does not include over-all unions which may have a sprinkling of engineers or technicians. The number of professional employes in these heterogeneous units is believed to be extremely small.

The unions involving technical employes in oil industries include:

. . . Association of Industrial Scientists—390 members at Shell Development Co., Emeryville, Calif.

. . . Association of Professional Engineers, Chemists, and Scientists—120 at The Texas Co., Port Arthur, Tex.

. . . Research and Engineering Professional Employes Association—600 at Standard Oil Co (Ind.), Whiting, Ind.

. . . Society of Professional Chemists and Engineers—290 at Baytown refinery of Humble Oil & Refining Co., Baytown, Tex.

REFINERY SUPERVISORS of D-X Sunray Oil Co. listen while Instructor Robert Patterson of the University of Oklahoma gives latest information on supervisory techniques.

Quick School for the Bosses

. . . gives Sunray's entire supervisory staff training in the basics of management within a 9-months' period.

A SPEED RECORD of sorts in giving supervisors basic training in management is being set by Sunray Mid-Continent Oil Co.

By the end of June, 540 supervisory personnel of the parent company and its refining and pipeline subsidiaries will have completed the training.

This means that management indoctrination has been given nearly every supervisor in the company within the 9 months since the program started last September.

The actual course given supervisors is similar to those used by many other oil companies. But Sunray's approach gives it some advantages. By indoctrinating the entire supervisory force within such a brief time, the company is able to:

. . . **Introduce the latest information** on management thinking quickly to the entire company.

. . . **Make beneficial effects** of the training felt immediately throughout the company.

Programs of this type usually are long-range undertakings. They are set up so that over a period of years supervisors are exposed to the training.

But Sunray officials are in no mood for waiting. The company by merger and rapid growth has been a major integrated oil company only a few years. It recently set up a plan to train its own bosses from the ranks (OGJ, Dec. 2, 1957, p. 64) and it wants to complete this first major undertaking under the program without losing any time.

What happened . . . The first classes in September were attended by various Sunray officials.

They liked what they heard and saw and came away enthusiastic. Their full endorsement of the training gave the program a big sendoff. Subsequent cooperation by all the supervisors made it a success.

The classes averaged 20 to 25 supervisors. Sessions in most instances were a week long with classes held during the 8-hour working day.

Tulsa was the site of many sessions. Separate classes were held there for supervisors in the Sunray home office, at the D-X Sunray refinery in West Tulsa, and at the company's southern sales division in West Tulsa. Classes also were held in Terre Haute, Ind., Madison, Wis., and Waterloo, Iowa, locations for division sales headquarters.

Final two classes for Tulsa refinery supervisors will be held this week under supervision of H. A. Brown, manufacturing vice president, and Ed Dons, refinery manager. Then later in the month the last session of the inaugural program will be staged in Duncan, Okla., for the second group of a 50-man class of Duncan refinery supervisors.

What is studied . . . The classes made use of visual aids, lectures, and class participation.

The instruction periods were based on a "Fundamentals of Supervision" program outlined by the University of Oklahoma. Topics included:

Management function, management chain, types of supervisory effort, fundamentals of leadership, basic human wants, how a supervisor meets his responsibilities, handling personnel problems, individual differences, supervisory relations, induction of a new employe, and summary of supervision fundamentals.

Conference leaders have been members of the OU business and industrial services staff. They included Director M. L. Powers and Instructor Robert Ferguson. Supervising the program for Sunray were Forney Hutchinson, manager of employe relations, and Everett Smith, training coordinator.

Why the training . . . Goal of the program is to increase efficiency of Sunray's management team from top to bottom.

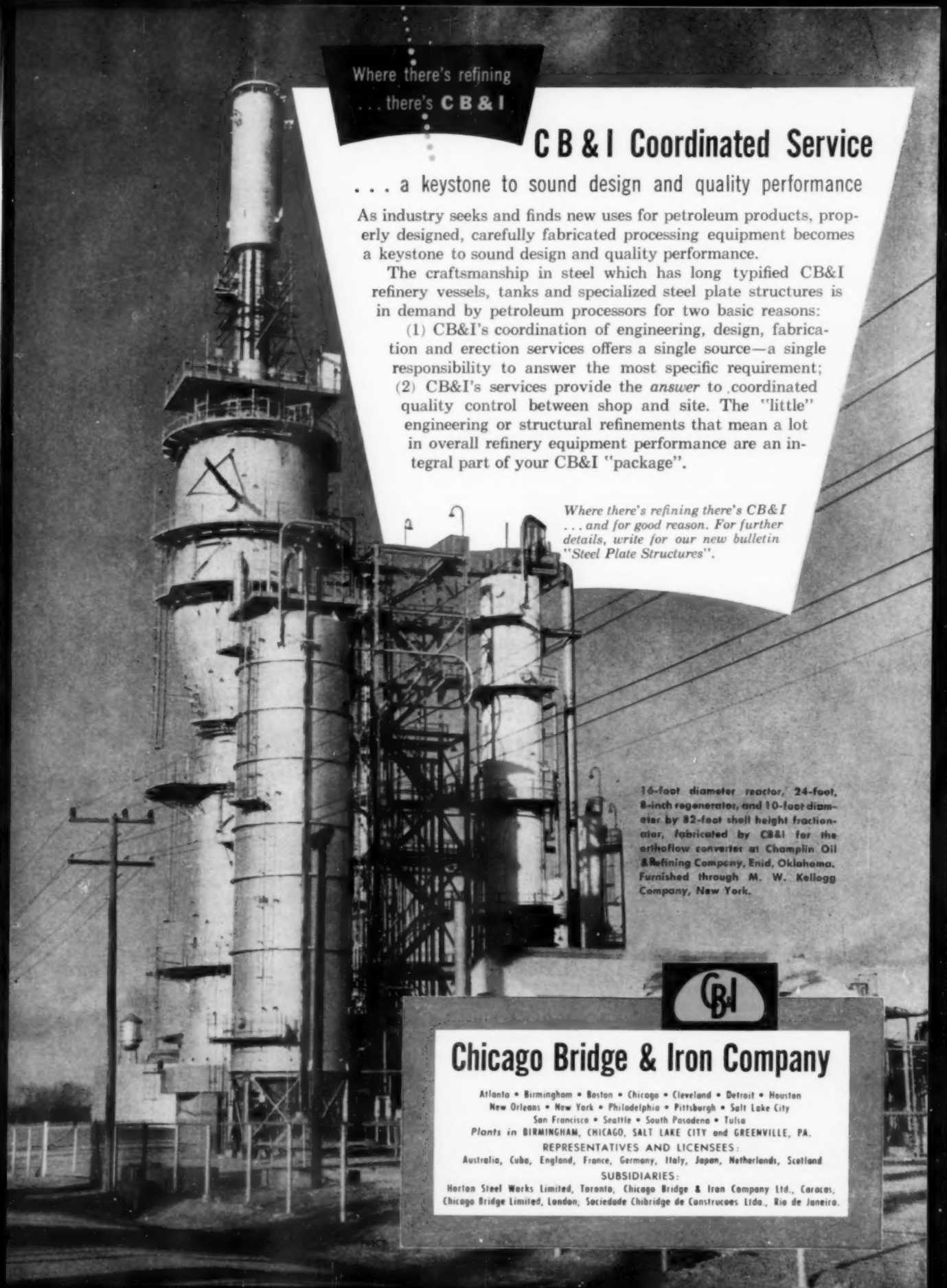
I. H. Hughes, administrative vice president, says the training program was based on the conviction that better supervisors make for better employe-management relationship. This in turn makes for better company operations.

"In this respect," Hughes comments, "we feel the program has been highly successful. In mid-June, we will have given 540 supervisors the benefit of this instruction. I have yet to hear anyone mention that the sessions weren't stimulating and worthwhile."

Hughes says more classes will be held in the future as new supervisors arise in sufficient quantity to justify the sessions.

Smith explains the courses are designed to help supervisors select and develop personnel and promote morale, pride, and greater output.

Emphasis also is put on protection and safety of employes, production of quality products, and efficient, economic, and effective production methods, he says.



Where there's refining
. . . there's **C B & I**

C B & I Coordinated Service

. . . a keystone to sound design and quality performance

As industry seeks and finds new uses for petroleum products, properly designed, carefully fabricated processing equipment becomes a keystone to sound design and quality performance.

The craftsmanship in steel which has long typified CB&I refinery vessels, tanks and specialized steel plate structures is in demand by petroleum processors for two basic reasons:

(1) CB&I's coordination of engineering, design, fabrication and erection services offers a single source—a single responsibility to answer the most specific requirement;

(2) CB&I's services provide the *answer* to coordinated quality control between shop and site. The "little" engineering or structural refinements that mean a lot in overall refinery equipment performance are an integral part of your CB&I "package".

Where there's refining there's CB&I . . . and for good reason. For further details, write for our new bulletin "Steel Plate Structures".

16-foot diameter reactor, 24-foot, 8-inch regenerator, and 10-foot diameter by 82-foot shell height fractionator, fabricated by CB&I for the orthoflow converter at Champlin Oil & Refining Company, Enid, Oklahoma. Furnished through M. W. Kellogg Company, New York.

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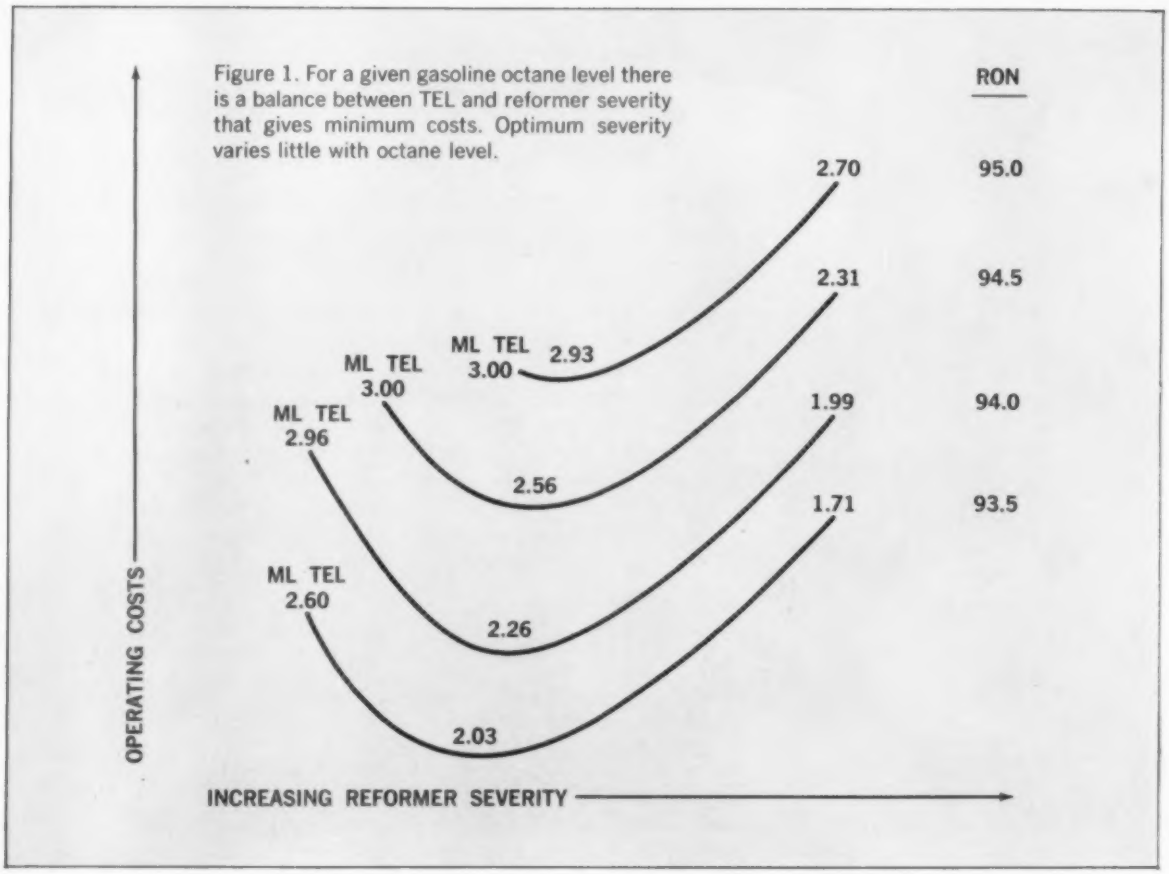

Figure 1. For a given gasoline octane level there is a balance between TEL and reformer severity that gives minimum costs. Optimum severity varies little with octane level.

Ethyl Research Studies Effect of Reduced Charge Rate on Octane-Improvement Costs

ECONOMICS of octane improvement are continually under study in the Detroit Laboratories of Ethyl Corporation. Such studies provide a broad background for solving the specific problems of refiners and also in achieving minimum octane costs.

This work is of particular interest now when the refining industry is operating at lower percentage of capacity. In the light of today's reduced charge rates, the Ethyl Corporation investigations show that refiners can realize substantial savings by re-examining their refining operations carefully.

Using rigorous economic analysis, refiners can define the balance between the cost of tetraethyllead and that of octane-improvement processes for a required gasoline pool. Analysis can also define the optimum allocation of tetraethyllead among the various grades of gasolines to be produced from the pool of components.

Tetraethyllead vs. Catalytic Reforming

In catalytic reforming and tetraethyllead the refiner has two means of octane number control. By increasing reforming severity, he increases octane number at the expense of gasoline yield. With tetraethyllead, he increases octane number at the expense of higher concentrations.

There is a definite balance between reforming severity and tetraethyllead concentration that results in minimum cost for any set of conditions.

Figure 1 is a typical plot of cost versus reformer severity for different Research octane number levels. Tetraethyllead concentrations are indicated on the cost curves. They decrease as severity is increased, and the optimum tetraethyllead is defined by the point of minimum cost. As octane number is increased, optimum tetraethyllead rapidly approaches maximum concentration. At the same time, reformer severity increases very little. Figure 1 is representative of many refining situations today.

Octanes Influenced by Crude Charge Rate

The refining industry is operating at a significantly lower per cent of capacity today than it was a year ago. This affects pool octane quality. At reduced crude runs, catalytically cracked gasoline makes up a bigger part of the gasoline pool

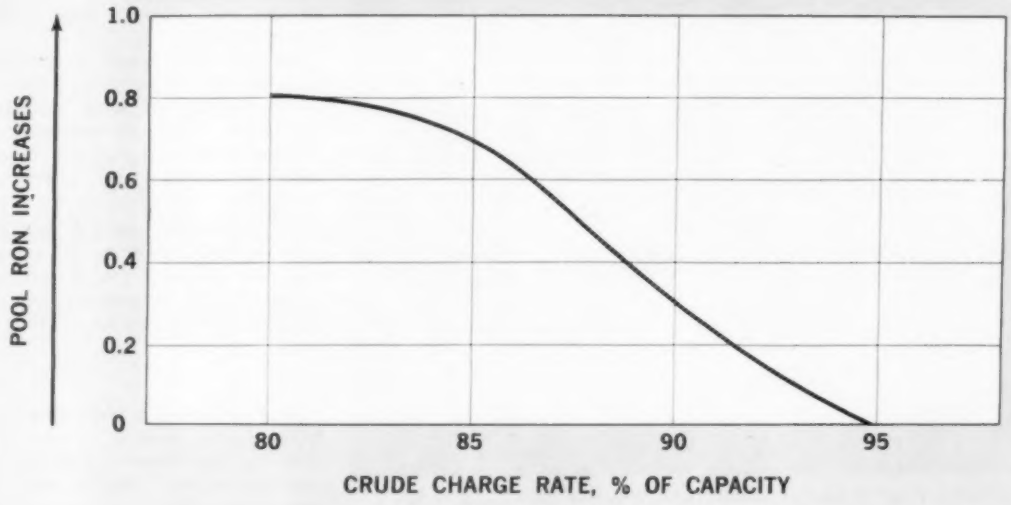

Figure 2. Effect of Crude Charge Rate on Pool Octane Number.

and pool octane quality may be higher.

Also, catalytic reforming capacity, as a function of crude run, is higher which enables a larger percentage of naphtha to be upgraded. Refiners must consider the effects that this stiuation has on their present and planned operations.

Figure 2 illustrates the effect that crude charge rate may have on the RON quality of a gasoline pool. A decrease in the percentage of crude running capacity in operation raises the pool octane number. This effect can be as much as 0.5 to 1.0 octane numbers.

Operations Today are Less Severe than Last Year

At present, relative to a year ago, reforming severity and tetraethyllead in the average refinery have undoubtedly shifted as a result of several factors. The higher ratio of cat cracking capacity and reforming capacity to crude runs enables refiners to produce a given octane quality with less severe operations.

Therefore, in order to make the best use of tetraethyllead and reforming for octane improvement, the balance between reforming and tetraethyllead must be frequently reviewed and studied.

Directionally, at lower percentages of capacity operated, reformer severity should be somewhat less (higher reformate yield) in order to get the most efficient use out of tetraethyllead. The curves shown in Figure 1 would shift to the left under these conditions.

Ethyl Research is constantly testing all of the variables which affect the use of tetraethyllead and the cost of octane-improvements. Results obtained are passed along to the Oil Industry to help individual oil companies achieve optimum production economy.

How Ethyl Research is helping you

Our Refinery Technology staff, backed up by the extensive facilities of the Detroit Laboratories, will be glad to share their experience with your economics people when you conduct an analysis of your octane-improvement costs.

For further information, call your Ethyl Representative. He will be glad to arrange an appointment for you with one of our Refinery Technologists.

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New York 17, N. Y.

RESEARCH LABORATORIES
1600 W. Eight Mile Road, Ferndale 20, Mich.
2600 Cajon Road, San Bernardino, Calif.

THESE are new officers of the Petroleum Electrical Power Association.*

Better Power Rates Sought

WHETHER gas-transmission firms use more electrical power in the future will depend a great deal on whether electrical utilities offer reasonable rates.

This is how a gas pipeliner laid it on the line for electrical utility folk assembled in Fort Worth for the thirtieth annual meeting of the Petroleum Electric Power Association June 3-4.

The pipeliner was F. P. Goertzen, of Texas Eastern Transmission Corp., Shreveport.

If reasonable rates are offered, Goertzen said, utilities can expect gas lines to go in for much heavier use of electrical power—for such things as electric-drive centrifugal compressors and a great variety of other power needs.

Power companies would benefit just as much as the pipelines, Goertzen thinks.

They would not only be hiking sales volume. The biggest benefit would stem from these added sales coming mostly during what is now the power industry's low-load season.

Southern electrical utilities have had their peak loads in the summer for years. And now several eastern utilities are experiencing the same thing for the first time in their history, Goertzen said.

On the other hand, gas pipelines' peak demands occur in the winter.

"We need your power generation capabilities at the very time when you are best able to meet those requirements," Goertzen said. "Even the weather is doing you a favor."

But, Goertzen asked, "Are your rate schedules also doing you a favor? Are they allowing you to sell more energy at the very time when you have the greatest capacity to sell?"

*Standing: Harold S. Nay, Kansas Gas & Electric Co., Wichita, director; D. S. Coffman, Texas Power & Light Co., Dallas, vice president; Paul B. Ferris, Empire District Electric Co., Joplin, Mo., director; Kirby Dawkins, West Texas Utilities, Abilene, Tex., director; J. F. Maddox, New Mexico Electric Service Co., Hobbs, N. M., director and retiring president. Seated: Roger Owen, Southwestern Public Service Co., Amarillo, Tex., director; Harvey A. Cherry, Jr., Houston Lighting & Power Co., Houston, new president; John Odom, Texas Electric Service Co., Midland, Tex., director; and W. M. Larkin, Gulf States Utilities Co., Beaumont, Tex., secretary-treasurer. Directors not shown are Thomas E. Graham, Oklahoma Gas & Electric Co., Oklahoma City; H. P. Lindsey, Arkansas Power & Light Co., Little Rock; and J. L. Satterfield, Pacific Power & Light Co., Casper, Wyo.

PROCESSING BRIEFS...

United Refining Co.'s crude capacity will jump from 8,000 to 15,000 bbl. daily when its new crude unit starts up later this month. The Warren, Pa., refinery is engaged in a $1,250,000 expansion program, including changes to its fluid cat cracking unit, its catalytic reformer, and addition of a pretreat section for straightrun gasoline.

Shell Oil Co. is planning a multi-million-dollar program for expansion and improvement of its lubricating-oil manufacturing facilities at Wood River, Ill. New facilities will increase production of high viscosity index oil from 2,000 to 4,000 bbl. daily. The program includes construction of a vacuum fractionating unit and a phenol solvent extraction plant to replace existing units. Dewaxing and deasphalting units will also be expanded and improved. Construction will begin this fall. Completion is scheduled in mid-1959.

Standard Oil Co. of California, Western Operations, Inc., will add a 40,000-bbl. fluid catalytic cracker to its refinery at Richmond, Calif. Work on the project is to start immediately, with completion scheduled for the summer of 1959.

American Petrofina Co. of Texas will soon start identifying service stations in the Wichita Falls, Tex., area with the trade name Fina. More than 50 stations will be involved in the first phase of the reidentification program, which will gradually spread through the nine-state marketing area.

Also for Refiners . . .

IN THE NEWS: Detroit is talking of 17:1 compression ratios but oil researchers tell SAE higher octanes won't solve all the problems involved (p. 62) . . . Two major California crude buyers have cut crude postings from 10 to 25 cents a barrel (p. 66) . . . Japanese have new 40,000-bbl. refinery on stream (p. 82) . . . Soviets plan to build 157 plants in move to step up production of petrochemicals (p. 85).

PLUS THESE TECHNICAL REPORTS: Instruments for heater-oil production (p. 100) . . . Modified equation predicts PVT behavior for similar gases (p. 105).

Pipe of Tenite Butyrate cuts downtime

This pipe resists paraffin plugging

The problem of paraffin plugging is often completely eliminated with pipe made of Tenite Butyrate. The clean, smooth inner wall of this plastic pipe offers no toe-holds where paraffin can start accumulating. These smooth walls also provide up to 40% greater flow volume than does metal pipe for the same head loss. Result: less load on pumps.

Pipe made of Tenite Butyrate offers many other advantages, too. It resists corrosion caused by sour crudes, salt water and alkali soils. It is extremely light in weight. One 20-foot length of 4" pipe made of Tenite Butyrate plastic weighs only 20 pounds—about one-sixth the weight of metal pipe of the same length and diameter. It is easily cut with a hand saw and joined quickly with only slip-sleeve couplings and solvent cement. Using this method, three unskilled men can lay 4,000 feet of 4" pipe in only one working day.

With Tenite Butyrate, you get a pipe line that is easily installed, that performs efficiently, and requires virtually no maintenance. You also get the substantial savings that accompany each of these advantages.

Write us for more information, as well as the names of companies that produce pipe and a complete range of fittings made of Tenite Butyrate. Address: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

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BUTYRATE
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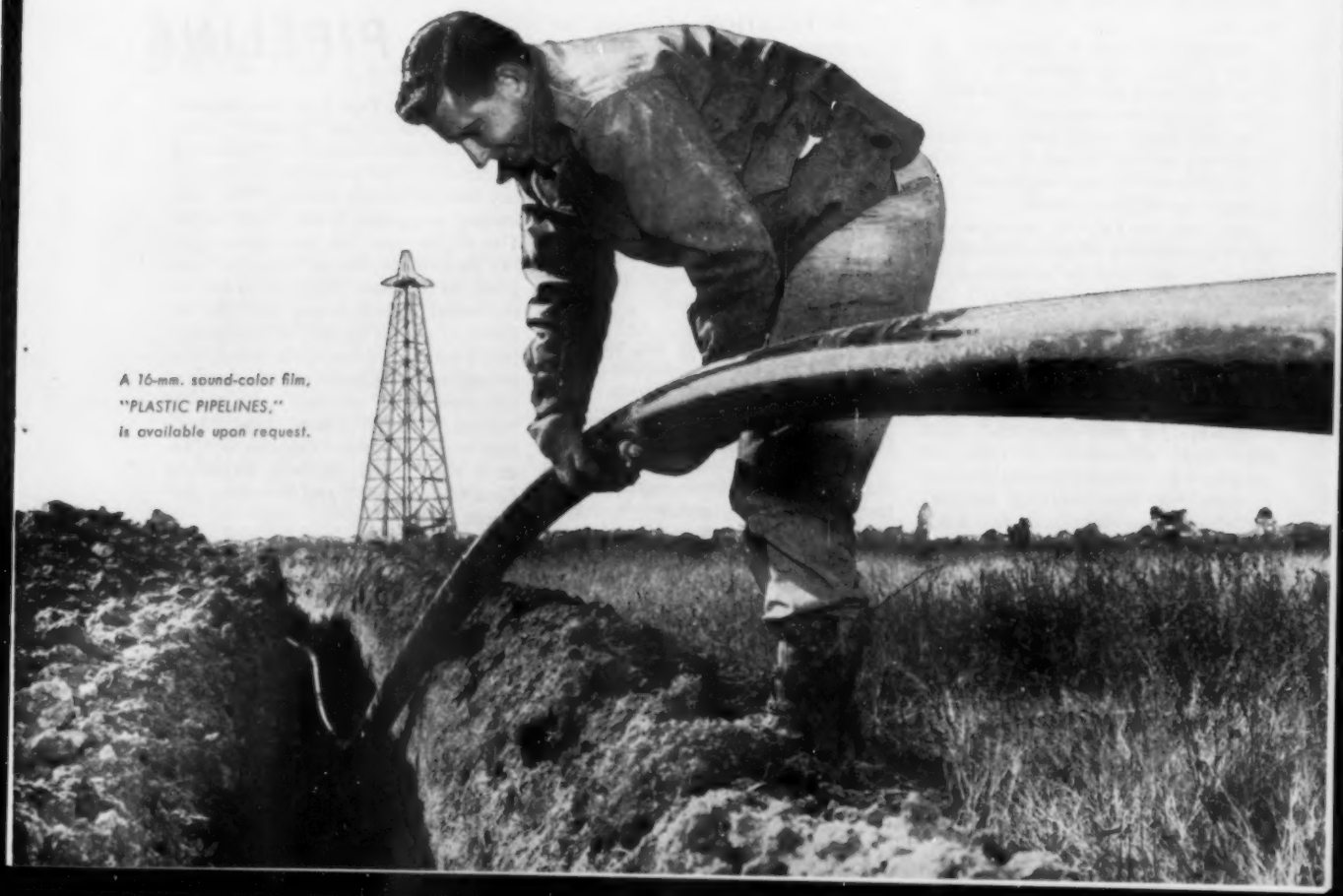

A 16-mm. sound-color film, "PLASTIC PIPELINES," is available upon request.

Craft Unions on Rise

. . . in refineries, despite opposition of OCAW and refiners. NLRB approves small bargaining units; raiding feared.

REFINERS find themselves in the odd position of being in agreement with the Oil, Chemical and Atomic Workers Union.

Both are concerned over an upsurge in the number of craft unions which have been certified by the National Labor Relations Board as bargaining units in plants formerly covered by O. A. Knight's AFL-CIO organization.

The NLRB long supported the CIO idea of one big union covering all crafts in a plant. Over the past few years, however, it has certified a number of craft unions, which were the basis of the old AFL.

When the two big labor bodies merged, union raiding was supposed to be halted. There is agreement at the top level, but at the bottom there is still rivalry between the local unions.

Competition feared . . . The OCAW is opposed to others setting up craft bargaining units because they chip away its strength. A plant where 99% of the workers are in the big union and 1% in a key separate craft unit can be closed down against the will of the 99% by a strike of the 1%.

Management also is disturbed. If it has to deal with unions, it would rather deal with one than with several, each with different demands.

At the same time, most refinery forces are set up in such a way that it is difficult, if not impossible, to identify the different crafts.

And, like the OCAW, management sees the possibility of operations being halted at any time by a walkout of a small group of key workers.

That very situation arose in April at the Wood River refinery of Standard Oil Co. (Ind.), where the NLRB had certified the boilermakers union as agent for 17 employes.

However, a plan where craft lines have been eliminated in favor of teamwork by several different types of workers has been working satisfactorily in Esso Standard Oil Co.'s Bayonne, N. J., refinery (OGJ, June 9, p. 72).

Other cases . . . There have been several other recent instances where the NLRB has certified craft groups.

The AFL plumbers union was allowed last month to set up a separate unit in the new refinery of the U. S. Oil & Refining Co.

Earlier this year, operating engineers were permitted to set up a separate bargaining unit in a Mississippi River Fuel Corp. chemical fertilizer plant where the OCAW asked for a plantwide unit.

In that case, the board explained the reasoning behind its certifications of craft units.

"The board has consistently held that in the absence of bargaining history on a broader scale, maintenance employes may constitute a separate unit," it said.

"We find, contrary to the contention of the OCAW and employer, that the integrated nature of the employer's operation does not preclude the finding of a separate maintenance unit appropriate. Accordingly, we find that the maintenance employes constitute a functionally distinct homogeneous group of employes, and may constitute a separate unit."

Tanker Probe Set

after Onassis cancels his contract for three ships.

CANCELLATION of orders for three new tankers by the A. S. Onassis interests last week sparked a congressional investigation.

The ships were to be built for American-flag operation under an agreement settling criminal and civil proceedings arising out of the purpose and operation of surplus government vessels.

The Federal Maritime Board was informed of the cancellation in a letter blaming the action on the reduction of oil imports.

Major oil companies are not only refusing to charter independent tankers but are laying up their own vessels as a result of the crude import program, it was explained.

Rep. Herbert C. Bonner (D-N.C.), chairman of the House merchant marine committee, immediately scheduled a hearing for June 17 to inquire into the default of the contract.

Bonner's committee held hearings last year to determine whether all proper precautions were taken by the Government to safeguard interests of the United States in its dealings with the Onassis group.

Under the out-of-court settlement Onassis agreed to build a 106,000-ton tanker and two 46,000-ton oil carriers in American yards. They were to be built for Victory Carriers, Inc. American citizen control was to be assured through the appointment of the Grace National Bank of New York as trustee to hold the majority stock of the corporation undertaking their construction.

As part of the transaction the Onassis interests were permitted to transfer to Liberian flag and ownership the 14 ships that had been involved in the original Justice Department proceeding.

Alberta Gas Line Under Way

CONSTRUCTION has started on a new segment of Alberta Gas Trunk Line Co.'s main-line project which ties into the Trans-Canada pipeline.

Fulton-Banister, Ltd., of Edmonton was awarded the contract for a 49-mile stretch of 34-in. line from Princess eastward to Cavendish, Alta.

In addition to the 49-mile section, Fulton-Banister was awarded the contract for two lateral sections—a 24-mile stretch of 26-in. line from Cessford south to Princess and 6,600 ft. of 18-in. line in the Cessford field.

The construction firm is expected to complete work on its contracts by the end of August.

PIPELINE

Great Lakes Pipe Line Co. shippers may upgrade regular gasoline deliveries from the company's 15 terminals by blending with premium to produce any interim octane number. The new loading procedure is on a trial basis. The shipper specifies the octane number desired or the per cent of each grade of product which he wants in the blend. Great Lakes said the decision to permit loading of two grades into a common delivery receptacle was in response to requests of shippers who indicated such practice is common elsewhere. Great Lakes ships 89-octane regular, which competes in Chicago with higher octanes from the Gulf Coast, and 98 and 99-octane premium.

Kerr-McGee Oil Industries, Inc., has made its third gathering-system purchase in Oklahoma this year. The latest was the 60-mile consolidated system of Pure Oil Co. in the Seminole, Depew, and Drumright areas which handles 1,800 bbl. per day. Kermac will take over all well connections and integrate the 4 and 6-in. lines with

Wildcat Hits Gas-Distillate Pay

A NEW Chester-Mississippian test, 16 miles from the nearest production, has opened another prospecting area in Oklahoma's Anadarko basin.

The 1 Grummer of Calvert Drilling, Inc., Tulsa, and King-Stevenson, Inc., Chicago, tested gas and distillate in a Kingfisher County test.

The producer falls within the limits of the Anadarko basin, an area of intense drilling activity and one of the nation's newer gas provinces.

Within the basin, exploratory drilling has enjoyed a fantastic success ratio during the past 2 years. It has hovered between 40% and 50%, compared with the national average of 20%.

To the northwest of the 1 Grummer, Calvert is completing another Chester wildcat, the 1 Bensch.

Testing . . . The 1 Grummer, drillstem tested at 8,202-10 ft., had gas to the surface in 3½ minutes after opening the tool and a spray of distillate in 90 minutes.

Initially the well flowed at the rate of 1,200 M.c.f. per day, and the flow increased to 7,000 in 1½ hours. The tool was open 2½ hours, and at the end of the test the well was flowing 6,400 M.c.f. per day.

Initial flowing pressure was 250 psi. This increased to 1,030 psi. at the end of the test. Preliminary examination of the MicroLog showed pay between 8,202-8,210 ft. and broken pay between 8,238-8,245 ft.

Calvert and King-Stevenson own 3,100 acres surrounding the well, which was drilled on an Ohio Oil Co. farmout. Pan American Petroleum Corp. and Gulf Oil Corp. are supporting the test.

Calvert's 1 Bensch discovery is located 3 miles north of Northeast Seiling gas-distillate field.

The well was completed for 43 bbl. of distillate per day, plus 987 M.c.f. per day from perforations in the Chester at 8,360-8,382 ft.

BRIEFS . . .

its present system, effective July 1. The Pure, Gulf Oil Corp., and Texas Co. gathering-line acquisitions added 50,000 bbl. daily to Kermac crude purchases in Oklahoma.

The soft crude and products markets the first quarter of this year were reflected in a 7% decrease in revenues of petroleum pipelines reporting to the Interstate Commerce Commission. Seventy-two per cent of the companies reporting experienced declines as volume dropped from 1,170,570,188 to 1,044,501,080 bbl. Three companies showing up for the first time are Four Corners, Muskegon, and Tecumseh pipelines.

Tennessee Gas Transmission Co. has awarded a contract to Williams Brothers Co., Tulsa, to loop part of its main line in Pennsylvania and New York. The contract is for 76 miles of 24-in. from Coudersport, Pa., to Hamburg, N. Y.

Transcontinental Gas Pipe Line Corp. has awarded two contracts for construction in Pennsylvania as part of its program which is still before the Federal Power Commission. Contracts went to Sharman, Allen, Gay & Taylor for 65 miles and Panama-Williams Corp. for 109 miles from the Leidy storage field to Transco's trunk line to New York. The storage line has 150 miles of 23-in. and 24 miles of 24-in. Continued delay in FPC clearance of the big project, including some 900 miles planned this year, is threatening to upset plans for completing it by the 1958-59 heating season.

British American Oil Co., Ltd., is building a gas-condensate gathering system in Pincher Creek field, Alberta. The company has contracted 20 miles of 2 to 14-in. construction to Mannix Co., Ltd., Calgary. Pincher Creek is being connected to Alberta Gas Trunk Line Co., Ltd., the gathering system for Trans-Canada Pipe Lines, Ltd.

Mannix is also working on a 90-mile, 10-in. transmission line from North Bay to Sudbury, Ont., for Northern Ontario Natural Gas Co.

Northern Illinois Gas Co. may develop a natural-gas underground storage project at Troy Grove 10 miles north of LaSalle, Ill. The company has asked the Illinois Commerce Commission for approval of a pilot project in the Mount Simon sandstone, found about 1,400 ft. A number of test wells have indicated the formation may be suitable for storage. If the experiment is successful, the storage reservoir would be ready for use by the winter of 1960-61. The company has already leased about 1,500 acres for the project.

Also for Pipeliners . . .

IN THE NEWS: New Texas' pipeline order sets up framework to force common carriers to connect wells (p. 59) . . . Survey crews working on the Saharien Pipe Line in Algeria get protection from French soldiers (p. 84).

PLUS THIS TECHNICAL REPORT: Weld defects avoided or detected by improved field welding and quality control (p. 118).

200 Return to Phillips Jobs

MORE THAN 200 of the 2,700 Phillips Petroleum Co. employes on strike in the Borger, Tex., area have returned to work voluntarily, Phillips officials announced late last week.

All Phillips plants in the area, including the refinery, are now operating, although not at full scale. The refinery is running 38,000 to 40,000 bbl. per day, compared with 60,000 bbl. before the strike, which began May 14.

Supervisory, technical, and nonunion employes are keeping the refinery in operation.

The 205 employes who have returned to work are employed in the natural-gasoline department, gas department, garage, tankcar shop, crude production, engineering, warehouse, and sales in Amarillo.

A Phillips spokesman said the company has reached agreement with the 21 employe units on virtually all departmental issues, but there are unsettled disputes on over-all issues with the union—Local 351 of the International Union of Operating Engineers (AFL-CIO).

Trouble at gas plant . . . One of the chief issues concerns the discharge of 33 employes of the gasoline department by Phillips on May 14, when the workers shut down the gasoline plant contrary to orders of the supervisors. The union wants the men rehired.

U. S. District Judge Joseph A. Dooley has issued a temporary injunction prohibiting union members and others from molesting Phillips property. The company charges that $831,418 damage has been done to installations by the striking workers.

The labor trouble began May 1, when union members at the butadiene plant struck on the issue of reducing the number of men per shift. The union's executive committee, representing workers in all the Phillips units, voted the general strike May 14.

Phillips officials said the workers who have returned to their jobs did so voluntarily and are working without a contract.

A federal mediator from Oklahoma City has sat in on some of the negotiating sessions but had returned to his home office last weekend.

Socony Revamps Marketing

SOCONY MOBIL Oil Co. will begin reorganization of its domestic-marketing department July 1. The reorganization, aimed at strengthening Socony's competitive position, will be completed by January 1, 1959.

Main changes include alignment of the department on the basis of class of customer instead of on product and changes in management functions. In the future sales will be directed at the division level through a resale sales manager, responsible for sales to service-station dealers, distributors, and fuel-oil resellers, and a commercial sales manager, who will handle sales to industrial, government, and commercial accounts. There will be 10 divisions.

Top officials under the new setup will include Glenn L. Werly, general manager; Baxter F. Ball, formerly vice president and director of marketing for General Petroleum, general sales manager; and Q. W. Regestein, general operations manager. H. E. Jenkins will be resale marketing manager with A. W. Warner as commercial marketing manager.

Louisiana Gas Tax Passed

LOUISIANA GAS producers soon must start paying a state gathering tax of 2 cents per M.c.f., double the present rate, unless they are successful in challenging the levy in court.

The Louisiana Senate passed the controversial tax increase last week and sent it to Gov. Earl Long for signature. House members approved the measure the week before. Long originally had proposed the increase to produce $25 or $30 million annually for higher teachers' salaries.

INDUSTRY BRIEFS . . .

Exploratory activity will be stepped up in Alaska's Bristol Bay area this summer, following a new agreement between Great Basins Petroleum Co. and General Petroleum Corp. The exploratory agreement was signed by Great Basins in its own behalf and as operator for a number of others. Geological parties are already in the field. The Bristol Bay, in southwestern Alaska, is hemmed in on the east and south by the Alaska Peninsula where leasing activity has been heavy (OGJ, Nov. 11, 1957, p. 116).

Albert B. Stevens, former general manager of Farnsworth & Chambers Oil Co., has bought the company's producing properties in West Texas. He has formed Albert B. Stevens & Associates, with offices in Houston, to operate the properties and engage in oil and gas property evaluation and management. Stevens, prior to joining Farnsworth & Chambers, was head of Texas A. & M. College's department of petroleum engineering.

General American Oils, Ltd., has purchased a 46⅓% interest in a 400,000-acre block in the Blueberry River area of northeastern British Columbia. The deal with Trevor Instruments, Ltd., and associates involved a $2-million cash payment and an $8-million noninterest-bearing production payment. The company is a subsidiary of General American Oil Co. of Texas.

Two more Texas producing properties were sold last week. J. M. Huber Corp., New York, paid more than $500,000 for a two-thirds interest owned by William Seale, Beaumont, in four flowing oil wells in South Hartburg field of Orange County. Landa Oil Co., Dallas, bought the interest of Carter & Carter, San Antonio, in 14 producing oil and gas wells in Hutchinson County in the Panhandle for $150,000.

Murphy-Canada Oil Co. became the largest single stockholder of Amurex Oil Development Co. when it acquired 588,550 shares of the company's Class A common stock. Murphy-Canada, a subsidiary of Murphy Corp., paid $3.35 a share to Ponder Oils, Ltd., for the $5 par value stock. Amurex holds an interest in 67 wells and 200,000 acres in Canada, 9 wells in West Texas, and 1 well and 100,000 acres in the Williston basin. The transaction will give Murphy an opportunity to consolidate interests in Canada.

The Alberta Government will offer 27 wildcat tracts and 32 parcels in five oil fields at its next big sale of crown reserve land July 22. Acreage in Kaybob field is expected to draw top bids at the sale. Last January, bids as high as $1,836 an acre were offered for leases in this area.

The Texas Co. has completed issuing 3,660,159 shares of its stock on a one-for-one basis to take full control of Seaboard Oil Co. Oil industry sources believe the new Texaco subsidiary, Texaco Seaboard, Inc., will be dissolved in 3 or 4 years and merged into the parent company.

Congrats and $25 to J. A. LONG, Rua Uruguaiana 118 - 9° andar Rio de Janeiro, Brazil

Joe Roughneck, heart of the oil and gas industry, likes the convenience and economy of having Lone Star's ultra-modern pipe mill right in the middle of his workshop. Lone Star maintains the largest mill stock of API casing and tubing in the entire oil country. Delivery can be made overnight to 75 per cent of the active areas. Lone Star's recently enlarged plant is, more than ever, Joe Roughneck's solid source of supply.

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Path in Venezuela to Get Rougher

• Politics and a weak international market, plus clamor for a cut bigger than 50-50 may knock some of the shine off the sunny outlook that followed the revolution.

THE OIL INDUSTRY came out of Venezuela's recent revolution unscathed, but there may be some rough jolts on the road ahead.

Internal political forces plus a depressed world oil market could spell trouble for the country's well-regulated and privately operated oil industry.

Executives of oil companies operating in the country are publicly optimistic about the future. They are inclined to discount the possibility they may be caught in the political floundering of a country testing its newfound freedom. There were indications last week that this optimism might not be on a very firm foundation

A number of influences have emerged in Caracas in recent weeks that could ripple the otherwise serene surface of Venezuela's private oil industry. Here are some of them:

. . . **Growing clamor** for the formation of a Venezuelan national oil company. This is being pushed by the country's Nationalists who think Venezuela can take a bigger cut of its oil profits. They are watching the breakdown of the traditional 50-50 profit split in the Middle East and ask the same for Venezuela.

. . . **Concern** over U.S. restrictions on oil imports that have helped cut Venezuelan oil production from peak figures of early last year.

Production is down more than 400,000 bbl. daily. Generally depressed world oil markets are as much to blame as U.S. import restrictions, but the fault is being laid at Washington's door.

. . **Increased activity** by Venezuela's small but potent Communist party.

The Reds aren't strong enough to be a political force in themselves, but they are well organized. They are already making themselves felt in oil's labor unions, in some government circles, and in influencing the man-in-the-street.

. . . **Vocal Nationalists,** like the Communists, are making the most of their release from the stringent controls of a dictatorship.

Many are politically ambitious and will be active in the campaigns to pick a new Venezuelan government. A private oil industry has long been a popular whipping boy in Latin American politics. Oil is a natural campaign issue.

. . . **Suspicion** of a thriving industry that grew and flourished under not one, but two hated dictatorships is hard to counter by private oil's good citizenship record in Venezuela.

Minister on the go . . . Dr. Carlos Perez de la Cova, the new Minister of Mines and Hydrocarbons, is one of the busiest men in the country

Dr. Perez made a hurried trip to Washington last week for a talk with Secretary of State John Foster Dulles about oil imports. What was said in that 40-minute chat was not disclosed, but Venezuela's responsible leaders are concerned over import restrictions and their effect on production.

Just a few days before, the pro-private enterprise Dr. Perez felt it necessary to call a Caracas press conference.

It was meant to point out some of the things he has often said before—a private oil industry has brought benefits to Venezuela that state-owned oil enterprises have not gained for other Latin American countries. He also very pointedly said that the Venezuelan government keeps a watchful eye on the private companies producing its oil.

For his efforts Dr. Perez got a bit of pummeling from some sections of the Venezuelan press.

HERE'S an over-all view of Japan's new, 40,000-bbl. refinery.

Japan's $47-Million Refinery

JAPAN'S THIRD largest refinery has gone on stream on the site of an old navy oil depot about 150 miles south of Tokyo. The 40,000-bbl. plant was built at a cost of $47 million at Yokkaichi by Showa Yokkaichi Oil Co. It is designed to meet market conditions forecast in Japan from 1960 to 1963. It also will supply feed stocks for a petrochemical plant to be opened on an adjacent site next year by Mitsubishi Petrochemical Co.

The Mitsubishi group holds 25% interest in the new refining company. Showa Oil Co. owns 75%. Royal Dutch-Shell, half owner of Showa Oil, participated in construction by providing $35 million of the initial cost in the form of a sterling loan. Shell personnel from London and The

In response to his comments, El Nacional, a Caracas paper, took issue with a number of his positive statements and said flatly that Venezuela's concession policy "should be replaced by a system of mixed enterprises in a country where the oil business has ceased to be a risky business. . . ."

Panorama, Maracaibo's leading paper, plugged definitely for a national oil company and "no more concession." The paper pointed out that Venezuela's oil industry was born and flourished under dictatorships.

"The discovery of oil in Venezuela began the known deformation of our economy to the detriment of our agriculture and cattle-raising industry," Panorama said.

Perez rebuttal . . . The minister countered the adverse editorial comment with some figures on Venezuelan oil in 1957.

Here they are:

. . . Venezuela's income from oil was $1,230,000,000 in 1957 compared to $973,200,000 in 1956. Included in the new record income was $360 million in bonuses for new concessions.

. . . Oil industry's net profit for the year amounted to $829,500,000, an increase of $160 million over 1956. The privately operated industry's gross income last year was $2,450,000,000.

Net investment of the industry in Venezuela was placed by the ministry at $2,578,000,000 with a capital expenditure total for last year of $913 million.

In spite of these healthy income and investment figures it will take caution and cool heads in both the government and industry in Venezuela to keep the ultranationalists and Communists from rocking Venezuela's oil boat in the months to come.

Platforms Dot Maracaibo

FIFTY NEW drilling platforms are going up on the Lake Maracaibo acreage held by Mene Grande Oil Co. (Gulf Oil) at the rate of one a week.

The new platforms are being built in the lake (OGJ, June 2, p. 87).

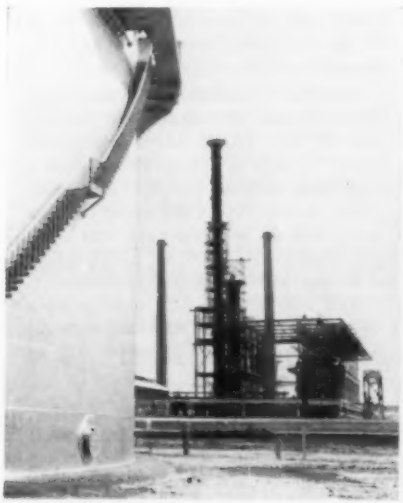
The new Meneg platforms will make a total of 159 built in the lake by this one company since the new concessions were granted in 1956. The platforms are being built by a subsidiary of Raymond International, Inc., and Brown & Root, Inc.

Jordan Exploration Starts

ZIMERI-JORDANIAN Oil Co., Inc., has started exploration operations on its concession in Jordan.

Offices have been set up in Amman, Jordan, and in Jackson, Miss. Dr. Han C. A. Swolfs, the company's chief geologist, and Robert W. Tyson, chief of exploration, are in Jordan organizing surface geological parties. Two of the parties are working in the Dead Sea graben in Central and northeastern Jordan.

Under terms of the concession contract, approved March 13, Zimeri-Jordanian has until September 13 to select one-half of the 16,600,000 acres of Jordan not under concession to Edwin W. Pauley, California independent operator, and Phillips Petroleum Co. (OGJ, April 7, p. 121). The exploration period is 10 years.



C-3, C-4 gas separator.

TANKER discharges at new 720-ft. jetty.

Designed to Meet Future Market Conditions

Hague also handled design and supervised construction, carried out by local Japanese contractors.

Other facilities at the plant include a 23,500-bbl. vacuum unit, a gas separator, straightrun gasoline treating of 8,500 bbl., cracked gasoline treating of 5,200 bbl., and kerosine treating of 6,250 bbl. A 12,000-bbl. fluid catalytic cracker will open in fall. A 40-ft. channel will be dredged within 1 year. This will permit simultaneous berthing of a 32,000-ton and a 40,000-ton tanker at the new 720-ft. finger pier.

Floating-roof tanks will be used for storage of 3,485,000 bbl. of crude and products.

The refinery will be capable of supplying 25% of the needs for GP-4 jet fuel for Japan's Self-Defense Force. The adjacent polyethylene plant will produce ethylene, polyethylene, and styrene.

The Shell Group now has an interest in four Japanese refineries through its half ownership of Showa Oil. Other plants are at Kawasaki, 27,000 bbl.; Hirasawa, 3,000 bbl.; and Niigata, 11,000 bbl.

Troops Guard Pipeline

. . . being laid in Sahara Desert by two French companies. Line will move Hassi Messaoud crude to Mediterranean.

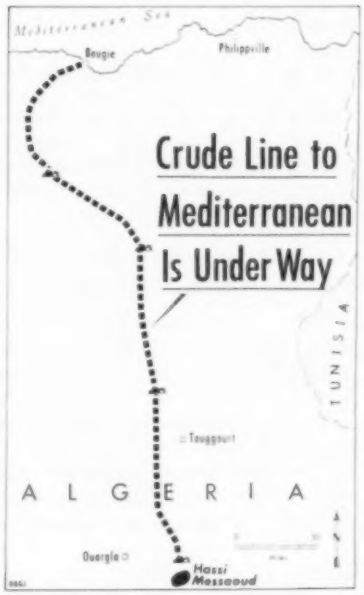
PRELIMINARY WORK is proceeding on the Saharien Pipe Line in Algeria under the protection of French soldiers.

Survey crews have the direct protection of some 200 soldiers and in addition there is the general protection which is assumed by forces of a few thousand men. Thus far there have been no Algerian rebel attacks to interrupt progress.

The 412-mile crude line is being built from Hassi Messaoud field in the Sahara Desert to Bougie on the Mediterranean Coast. It will be 24-in. for all but the last 81 miles, which will be a gravity-flow section 22 in. in diameter. This section drops from 3,000 ft. elevation to sea level.

The line will be built and operated by Ste. Petroliere de Gerancie (SOPEG), an affiliate of Cie. Francaise de Petroles (Algerie), and Ste. Nationale de Recherches et d'Exploitation des Petroles en Algerie, the two companies developing the field.

These private companies have financed the $100-million project by sale of securities. The oil companies and investors are confident the line can be completed and operated successfully. In spite of current unsettled conditions, the 6-in. pipeline to Touggourt has been operating and the tank-car shipments from there to the Mediterranean have been going through steadily.



Construction . . . Two spreads are working on the line.

Entrepose Co. and Ste. Parisienne pour Industrie Electrique (SPIE) have 281 miles in the desert, through which they expect to lay 31 miles a month. SOCOMAN, a French contractor owned by a steel firm, will lay the remaining 131 miles, including 25 miles in the mountains. Progress is expected to be 15 miles per month.

A double-jointing yard will be set up within a month at the Touggourt railhead, using automatic welding equipment recently shipped from the United States. Welding on the line is scheduled to start October 15. Progress will be impeded by dust storms in the desert and snow in the mountains.

The entire project is to be completed by the end of 1959.

The line will be buried as a precaution against sabotage, and coated and wrapped in the conventional manner.

Capacity, expansion plans . . . Saharien Pipe Line will have initial capacity of 101,760 bbl. per day with two pump stations, 201,400 bbl. per day with a third station, and 296,800 bbl. per day when a fourth station is constructed.

The original stations will have two 2,000-hp. diesel engines driving centrifugal pumps. One unit will be on standby. Engines will burn the 43°-gravity Hassi Messaoud crude, which has been tested in this country by the manufacturer which will supply the engines.

In the first expansion step the skid-mounted engine units at the originating station will be moved to another station and replaced by electric motors. A gas-turbine generating plant will be built to serve other oil installations and the community which is rising at the field.

Jacques E. Bouvet, general manager of SOPEG, is touring pipeline-construction projects and pumping stations in the United States and contacting manufacturers who will supply equipment and machinery for the line.

William G. Heltzel, Tulsa, is consultant on the project for Cie. Francaise des Petroles.

Pipe is being supplied by Lorraine Escaut, affiliated with Entrepose and SPIE; Pont a Mousson, a SOCOMAN affiliate; Joseph Paris; Mannesmann, a German firm; and U. S. Steel Corp.

Monagas Wells Hit

by Pan Venezuelan in Jobo field considered important.

PAN VENEZUELAN Oil Co. has completed its second and fifth Jobo field wells in Venezuela

The company, a subsidiary of Pan American Petroleum Corp., reported important flowing oil recovery from Mona J-2 and Mona J-5, located in Block 11, State of Monagas.

The J-5 flowed from the upper Oficina at the initial rate of 1,816 bbl. of 14.6° gravity oil a day. Maximum rate of flow was 2,200 bbl. a day through a 1½-in. choke. Minimum flowing rate was 440 bbl. a day through a ¼-in. choke. Upper perforations covered the interval 3,562 to 3,658 ft., with top of pay at 3,560 ft.

In the lower Oficina, J-5 produced an average of 480 bbl. of 8.5° oil a day on the pump from 4,060 to 4,150 ft. The lower Oficina was topped at 3,792 ft.

Mona J-2 recovered oil from the upper Oficina at a maximum flowing rate of 985 bbl. of 14.5° gravity oil a day through a 1½-in. choke, and a minimum rate of 214 bbl. a day on ¼-in. choke. Top of the upper Oficina was 3,400 ft. and recovery was from the interval of 3,400 to 3,465 ft.

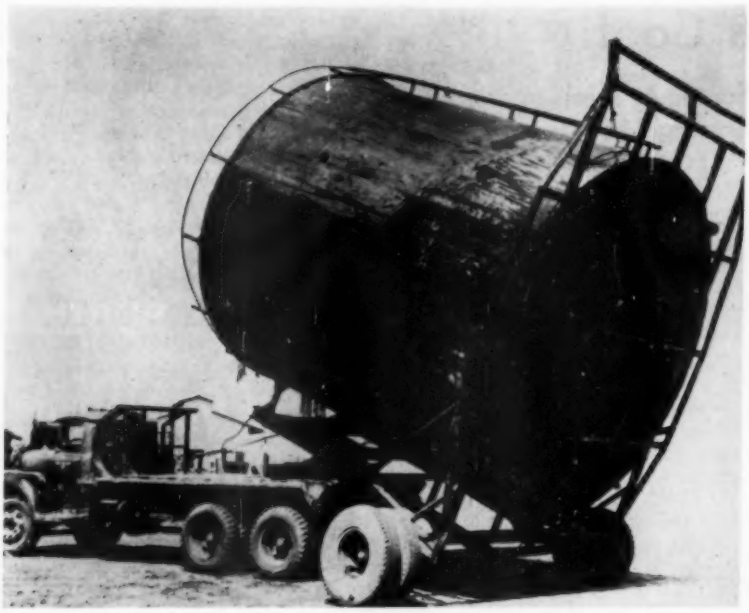
In the lower Oficina, recovery averaged 480 bbl. of 8.5° gravity oil a day on the pump. Producing interval was 3,745 to 4,070 ft., with top of pay at 3,732.

Bolivian Wildcat Has Show

BOLIVIAN GULF Oil Co. had good oil and gas shows while drilling its first wildcat on a 1,235,000-acre concession in southern Bolivia.

The 1 Mandeyapecua, 90 miles north of the Argentine border, yielded 26 ft. of sand with shows of gas and 50°-gravity oil in a core of the lower Tarija at 5,916 to 6,190 ft. The test, which is scheduled to go to about 12,500 ft., is drilling ahead below 6,555 ft. The objective is the Devonian. The wildcat is about 30 miles southeast of Camiri.

Bolivian Gulf is owned by Gulf Oil Corp. and three Tulsa companies, Falcon Seaboard Drilling Co., Williams Brothers Sudamericana, Ltd., and Barry & Reiner, Inc.



Detachable Wheel Speeds Tank Moving

CIA. SHELL de Venezuela is moving 500-bbl. tanks between drilling locations in almost half the time it used to take.

The company's transport department in Lagunillas district came up with a faster method by fitting detachable wheels to a modified tank skid (photo). The skid, complete with tank, can be towed behind a 4 or 6-ton truck by means of a detachable "fifth wheel" fitted to the platform of the truck.

It takes 3 minutes to connect the tank and skid to the truck, and 2 minutes to disconnect. An added advantage is that a lighter truck can be used.

Tanks formerly were slung on the rear of a heavy platform truck by winch line, a slow and cumbersome operation.

Russia to Build 157 Plants

. . . in a move to step up production of synthetic rubber and other petrochem products, according to Soviet press.

RUSSIA'S petrochemical industry has been given a leading role in the Soviet Union's newly launched, 8-year program to accelerate chemical and synthetics production.

More than 100 billion rubles ($25 billion) has been allocated to the "shock-tempo" drive which calls for increasing artificial and synthetic fibre manufacturing capacity by 4.6 times, plastics and synthetic resins capacity by 8 times, and synthetic-rubber capacity by 3.4 times.

According to an article in Novoye Vromya, this will require construction of 157 new plants and expansion of 100 others between now and the end of 1965.

Premier N. S. Khrushchev, in announcing the goals, declared:

"In 1965 we intend to use more than 51,000 bbl. daily of liquid hydrocarbons from oil gas (natural gas) for the manufacture of chemicals."

Reds trailing . . . Khrushchev frankly admitted that the USSR lags behind the United States and "certain other capitalist countries" in the production of synthetic materials.

He said Russia now ranks sixth in the world in making artificial and synthetic fibers and fifth in plastics. He charged:

"Ours was the first country to produce synthetic rubber. But the directors of our chemical industry were much too late in realizing the need to shift from food raw materials to lower-cost oil gas with the result that in volume of synthetic-rubber output we are now behind the United States, although we produce much more than all the other capitalist countries together.

"The Ministry of the Chemical Industry and the former Ministry of the Oil Industry underestimated the value of oil gases and natural gas, which represent the most accessible and cheapest raw material for synthetics. Emphasis was placed on the construction of comparatively small plants using byproduct gases from oil refineries.

"But the refineries supply only a comparatively small quantity of these gases, and their composition changes, depending on the type of refined product. This, of course, impedes operations. Construction of big plants using oil gas was neglected.

"For a long time the directors of the chemical and oil industry bargained over every ton of byproduct gas and placidly looked on as millions upon millions of cubic meters of much more valuable oil gas went up in flames. They can be likened to Plushkin, the Gogol character who bargained over half a sheet of writing paper while his crops lay rotting in the fields."

The Russian premier said that the Soviet Union will obtain over 318 billion cubic feet of natural gas this year. But he noted that "up to 40% of this gas is simply burned at the oil wells."

Shell Sets Price

on its Boscan crude to enter market held by Richmond.

THE HEAVY crude market has another supplier now after Cia. Shell de Venezuela posted a price for viscous Boscan crude and got ready to supply customers.

Shell's price of $1.72 flat for the 10°-gravity crude signaled its entrance into a market that has been held by Richmond Exploration Co. up to now.

Shell built a 34-mile, 16-in. heated pipeline to move the crude from its field on the west side of Lake Maracaibo, across the lake neck, and to the new Puerto Miranda terminal which is now under construction. The pipeline will have a normal capacity of 75,000 bbl. daily, but Shell is now moving only about 18,000 bbl. (OGJ, Dec. 9, 1957, p. 88).

Richmond discovered the heavy crude field in 1946 and then had to go out and develop markets for it. Richmond has 300 wells in its portion of the field and moves its production by pipeline to the Bajo Grande terminal on the west side of the lake. Shell has about 40 wells in its Boscan acreage

Argentina Still Is Cool

. . . to American companies hoping to invest in private oil activity. Government policy change fails to materialize.

WITH THE dust settling after the first hectic weeks in office for Argentina's new president, it appears that no drastic changes are in the works for the government's oil policy.

President Arturo Frondizi seems to have fallen back on the program of seeking foreign help by way of large-scale credits with fixed-fee service contracts between Yacimientos Petroliferos Fiscales and foreign companies.

Visitors at his inauguration last month got the impression that he was willing to work out some sort of deal to permit private investment in local oil operations.

Yadarola plan backed . . . There was speculation that he would favor some version of the plan proposed by Dr. Mauricio Yadarola, former Argentine ambassador to the United States.

The Yadarola plan avoided use of the politically touchy word "concession," using the expression "service contracts." But the results would have been about the same, with American companies risking money and sharing in profits.

Representatives of major companies, however, have come away with the view that the welcome mat won't be out for a long time. The new head of YPF, Arturo Sabato, is reputed to be an extreme leftist and a strong believer in state control of oil.

The present policy is a middle-of-the-road plan in the face of the country's worsening problem of paying for growing imports. Huge foreign investments are the best bet to make the country self-sufficient for crude.

But major companies are not interested unless they can share in the profits. Communists, Nationalists, and the president's own Radical party are conducting a heated campaign against this kind of contract.

Companies signing a service contract agree to undertake drilling or other services at a fixed fee to be paid in foreign currency or freely convertible pesos. Credits for the work must be arranged by the company. These will be guaranteed by the government at prevailing interest rates.

YPF has had its most success with this type of deal in arranging for pipeline construction. A contract drilling agreement was made with Laughlin-Porter Drilling Co. of Midland, Tex., for 40 development wells on Tierra Del Fuego. But this is snagged on a question on bond (OGJ, Feb. 10, p. 85).

Among the companies reportedly sounding out the country on contracts recently was Pure Oil Co.

WORLD BRIEFS . . .

Gulf Oil Corp. has named its newest tanker, Ragusa, after its Sicilian field. The 31,000-ton vessel was launched in the Netherlands.

Deutsche Shell is due to put a crude distillation unit on stream at its new Hamburg-Harburg refinery by the end of June. The 40,000-bbl. still is almost completed, along with a 12,000-bbl. catalytic hydrodesulfurization unit. A fluid catalytic cracker and a Platformer will be completed later this year.

Work on foundations is under way for the company's new refinery at Godorf in the Rhine basin. The plant will open at 30,000 bbl. daily in mid-1960 It will be boosted to 80,000 bbl. daily in 1962.

A new marine terminal has opened at Las Morachas on the east side of Lake Maracaibo, between Lagunillas and Tia Juana. Terminales Maracaibo C.A. initially is operating crane service from the dock to rental sites of oil companies and contractors. It can handle vessels up to 14-ft. draft, has a heliport, and storage space for pipe, fuel, and water.

A shop for diesel overhauling, a repair yard for launches, and storage for cement and other construction materials will open soon.

Russia expects Poland to be a fast-growing market for Soviet oil through 1960. According to official Russian estimates, Poland will import about 23,000 bbl. daily of refined oil products in 1960, compared with 14,000 bbl. daily in 1957. Soviet crude exports to Poland will increase from 13,000 bbl. daily to 14,000 bbl. daily in the same period. This year, the USSR will supply a record 90% of Poland's crude oil and oil products imports.

The first export shipment of LPG produced in Venezuela has loaded at Creole Petroleum Corp.'s terminal at La Salina on Lake Maracaibo.

The LPG came from the company's new 17,130-bbl. plant at Ule, the largest in Latin America. An initial shipment of 11,500 bbl. was pumped aboard a specially-designed motor ship owned by Tropigas, an independent marketing company.

An 820-bbl. lube plant will open soon at the 345,000-bbl. Amuay refinery of Creole Petroleum Corp. It will process distillates made from Tia Juana medium crude. The plant includes phenolization and propane-treating equipment.

Two pipelines linking Shell-BP Petroleum Development Co.'s oil fields in Nigeria with Port Harcourt are now in operation.

Latest to start up is a two-stage line. It consists of a 7-mile, 8-in. section from Oloibiri field to Kugbo Creek and 70 miles of 10-in. from the creek to Port Harcourt. Capacity is about 5,000 bbl. daily. A 30-mile, 6-in. line from Afam to the port handles about 2,500 bbl. daily.

Talon Petroleum Co. plans to expand its La Estacada facilities into the first large-scale terminal north of the proposed Maracaibo bridge in Venezuela. The small producing company intends to form a wholly owned subsidiary for the project.

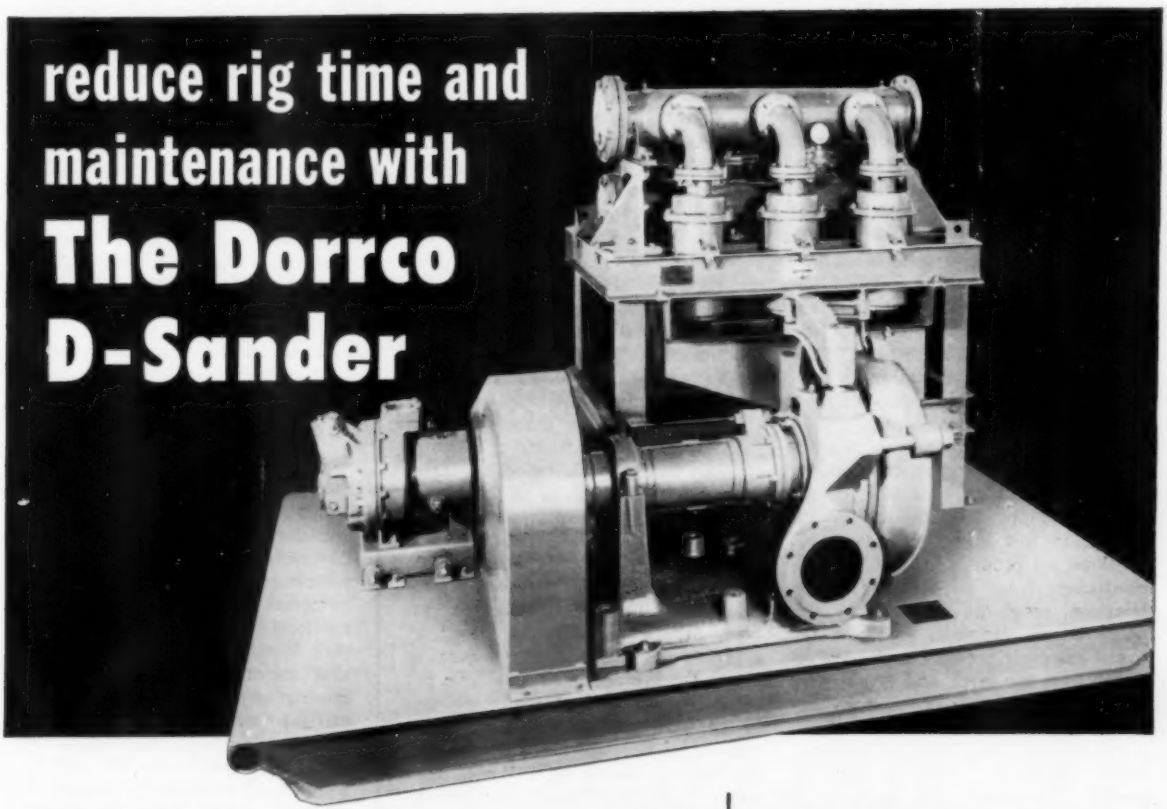
Austria's state oil administration expects to complete the first stage of its 49,000-bbl. Schwechat refinery by the end of next year. The work will cost about $22.3 million.

Cie. Shell de Venezuela is about to consolidate its personnel in Caracas. The company has signed a contract to rent more than 322,000 sq. ft. in the first 13 floors of a new building to be built in the eastern part of Venezuela's capital. The new space will house all of Shell's Caracas employes, now scattered through half a dozen buildings, under one roof. The building will be air conditioned.

A new $5,500,000 deepwater pier which will serve two 54,000-ton tankers at one time is being built at the 195,000-bbl. Cardon refinery by Cie. Shell de Venezuela. The new pier, Cardon's fourth, will be 1,384 ft. long and is being built on prestressed concrete piles, the first to be used at Cardon.

RIG OPERATORS...

reduce rig time and maintenance with The Dorrco D-Sander



The best answer yet to the problem of sand accumulation in drilling muds, the Dorrco D-Sander provides a means for continuous removal of abrasives, returning to the mud pump a low-solids mud containing less than 0.2% API sands.

To the rig operator . . . this may readily be interpreted in big dollar savings on . . .

Surface equipment — slush-pump maintenance costs are drastically reduced . . . tank cleaning for removal of sands and solids is practically eliminated.

Bit performance — is extended considerably with a corresponding reduction in the number of round trips, longer R.O.B.

Actual rig cost savings shown are drawn from a Gulf Coast operation, figures are based on six comparative wells in same field.

Typical Savings with D-Sander 0-9500 Ft.

Actual rig time saved

rotating.....45 hrs.	
round trips..... 8	
downtime cleaning tanks.. 4	
57 hrs. at $62.50	**$3,562.50**

Actual equipment savings

2-9⅞" bits at $250.00	$500.00
Mud pump parts.....	1,400.00
Surface mud equip. (est.).....	250.00
Total Savings per well	**$5,712.50**

For more information on the Dorrco D-Sander contact our U. S. Sales Representative, Salt Water Control Inc., 1211 Fort Worth National Bank Building, Fort Worth 2, Texas.

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These authors believe

Water-flood oil recovery

1. Secondary water-flood oil recovery in Texas

REFERENCE frequently is made to secondary oil production without distinction as between secondary water flooding and pressure maintenance of all types. Pressure - maintenance oil production in Texas far exceeds the secondary water-flood total. Fancher[2] reports that during 1955, oil production from fields subjected to fluid injection amounted to 30.4% of the state's total. For the same year, 1955, Sweeney[3] reports a figure for water-flood oil production in Texas amounted to 3% of the state total.

In order to arrive at the production attributable to water flooding which is subject to permissible capacity production, a definition is required. In this study, secondary water-flood oil production is defined as production from all of those water-injection programs which were initiated in oil reservoirs in which the initial reservoir pressure had been reduced to a low level, and which were essentially depleted of primary reserves.

Production from pressure-maintenance operations involving water injection is excluded. The majority of secondary water - flood projects employ dispersed pattern-type injection programs. In most cases the five-spot system has been employed, using an injection well for each producer.

Procedure . . . For obtaining increases in allowable for secondary water floods, this has been outlined in the Texas Railroad Commission's memorandum of August 12, 1953, pertaining to water-flood allowables. Under the memorandum, increases in allowables and exemption from shutdown days are not granted until production capacity has been increased by water-injection stimulus so as to require an increase to avoid restriction.

A majority of water-flood projects presently are operating at allowable rates well below the permissible prorated level for the comparable primary production. Actually, based on a recent 12-day producing month in Texas the average daily allowable per secondary water-flood producing well in Texas was 17.3 bbl. If an equal number of injection wells is included, the average would be 8.7 bbl. daily per well. By comparison, the average daily oil production per well for all wells in Texas was 15.3 bbl. in 1957. Table 1 shows a breakdown by Railroad Commission districts of secondary water-flood allowables.

The tabulation only tells part of the story. The total 121,000 bbl. of secondary water-flood allowable is about 4% of the state total during a 12-day month, and about 5% during a 9-day month. Actually, this figure is misleading insofar as it relates to capacity or unrestricted water-flood production. Unrestricted allowable

TABLE 1—WATER-FLOOD ALLOWABLES—STATE OF TEXAS

Railroad commission district	Number producing wells	Cal. day allowable barrels	Avg./well/ cal. day barrels
1	101	1,279	17.7
2	39	680	17.4
3	19	183	9.6
4	628	8,987	14.3
5	105	1,466	14.0
6	103	1,276	12.4
7-B	1,043	9,461	9.1
7-C	55	1,226	22.3
8	2,378	69,802	29.4
9	2,477	26,560	10.7
10	48	395	8.2
Total	6,996	121,315	17.35

Practicing engineers

WATER FLOODING is a proven method of recovering oil — oil which only a few years ago was considered residual oil or unrecoverable oil. The conservation of petroleum resources is furthered immensely by the addition of water-flood oil reserves to our country's supply of this valuable natural mineral resource. With the more general use of water-flooding methods by many oil producers, both independent and major oil companies, the technology of the water-flood oil-recovery process is gradually moving from the classification of an art to that of a science. There is, however a vast amount of work to be done by technologists of many skills before the water-flooding process is fully and clearly understood.

Production rate . . . Today we find a wide gap between some scientists with their laboratory models and engineers who are planning, installing, operating and observing results of water floods in the field. The conclusive evidence which points up the fact that the water-flooding mechanism is not fully understood, is the review of the disagreements among the laboratory technologists themselves as to the question of the effect of rate on water-flood oil production. A discussion of this subject is presented in the last section of this article. There is no doubt in the mind of

is lessened by restricting rates

BY J. F. BUCKWALTER, G. H. EDGERTON, W. E. STILES, R. C. EARLOUGHER, G. L. BUCKLES, AND P. M. BRIDGES
Wichita Falls Austin, Tex. Tulsa Tulsa Monahans, Tex. Abilene, Tex.

may be defined as allowable in excess of the top allowable ordinarily assigned to primary production. Primary allowables in Texas are, in most instances, limited by figures tabulated on the basis of depths and acreage used as a yardstick.

Such yardstick allows on a basic 10-acre unit, 9 bbl. daily for each 500 ft. of depth or increment thereof, to 2,000 ft. and 9 bbl. for each 1,000 ft. below 2,000 ft. to 7,000 ft. plus 1 bbl. daily for each acre per well in excess of 10 acres. A well on 10 acres in the depth range from 2,000 to 3,000 ft. would receive a yardstick allowable of 45 bbl. Subjected to 9 producing days, the 45 bbl. would amount to 13 bbl. daily during a 31-day month, and 17 bbl. daily during 12-producing-day schedule. A 20-acre five-spot with an injection and producing well each assigned a prorated top allowable would have 26 to 34 bbl. daily per producing well.

There are leases under water flood which have been assigned allowables in excess of prorated levels. The reason for controversy concerning water flood allowables is the allowable assigned in excess of prorated levels. Such excess allowable is the only sig-

don't agree with proponents of restriction—here tell why

anyone who has followed the controversy, that an extremely wide difference of viewpoint and opinion exists between the practicing water-flood engineers and some of the laboratory research engineers. The authors of this paper are practicing, consulting engineers who have fundamentally different concepts of actual water-flood behavior from those expressed in an article in The Oil and Gas Journal on May 13, 1957, by Jordan, McCardell and Hocott,[1] titled "Effect of Rate of Oil Recovery by Water Flooding." That paper was authored by laboratory research engineers.

Restricted rates . . . Effect of restricted rates on oil recovery by water flooding is a damaging effect. Oil recovery is reduced by restrictions of rates. This fact is of vital importance to the petroleum industry. Some oil producers have voiced their objections to any restrictions that may be imposed on the rate of production in water floods. This paper is sponsored by a group of oil producers, both large and small, which believes the industry as a whole should understand the magnitude and importance of the problem of restriction of water-flood oil production.

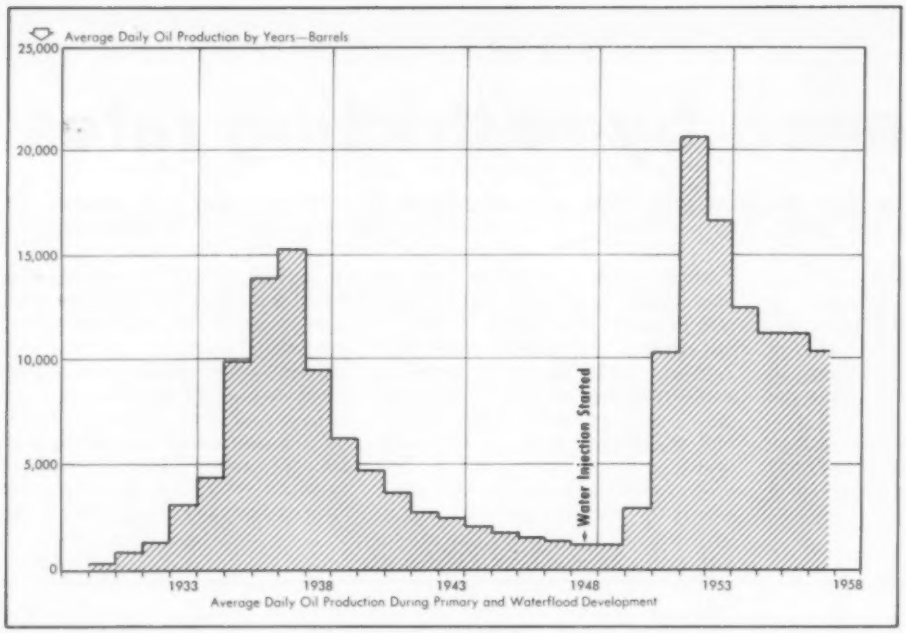
Objective . . . The purpose of this effort is to present data showing why restrictions of water-flood oil-production rates cause losses in oil recovery. Laboratory methods not backed up by field data cannot be used for this purpose. The only valid answer to this question is found in the field. The sincere aim of this joint effort of oil producers and engineers is (1) to determine the actual quantity of oil produced in several states which is attributable to water flooding; (2) to show the economic effects of restrictions of water-flood oil production; (3) to analyze and refute the approach taken by certain research technicians who try to show that no losses occur at slow rates or by restricted withdrawals in water floods; (4) to demonstrate losses of oil production by restrictions, and (5) to discuss the findings of several laboratory studies on this subject.

Terms . . . Part of the answer to the problem of understanding the nature of water flooding is in a clear definition of terms. Some persons use the term water flooding to include any process by which oil is displaced by water in a reservoir. They would define water flooding, therefore, to include natural water-drive mechanisms and pressure-maintenance projects where water is injected into reservoirs which never experienced appreciable pressure depletion. These latter methods of oil recovery are not water-flooding procedures or processes as defined by the general industry use of the term.

In all cases in this discussion water flooding refers to the process of recovery of oil by injection of water into oil reservoirs in which the initial reservoir pressure has been reduced to a low level and which are essentially depleted of primary reserves before water injection is started. The usual water flood of this type makes use of a pattern arrangement of injection and producing wells, the familiar five-spot pattern being the one most universally employed.

In this type of oil-recovery process a "void space" in the reservoir, which is usually occupied by low-pressure gas, must be filled with the injected water or oil before the pore spaces are completely liquid filled. This fill-up requirement is a characteristic reservoir feature which distinguishes the true water flood from the natural water drive or pressure-maintenance project.

There are seven parts to the accompanying discussion. Each part presents a different aspect of the general subject. It is not the intention of this article to present a complete or comprehensive treatment of the effect of restricted rates on oil recovery by water flooding. This initial effort is by the way of introduction. Other papers will contribute additional material and more fully develop the subject.



OIL-PRODUCTION history of South Ward field, Ward County, Texas. This performance chart reflects that the secondary oil-production peak exceeds the primary peak by only one-third, even though secondary reserves will probably exceed primary reserves by 100% or more. Fig. 1.

nificant figure involved. It is estimated that the excess water-flood allowable (above prorated levels) assigned to individual leases would range from 15,000 to 25,000 bbl. daily.

This figure represents approximately 1% or less of the state total, based on 9 producing days. As a parallel, in individual fields under primary operation with maximum efficiency rates in excess of yardstick allowables, it is probable that the total allowable in excess of yardstick values exceeds the total of above yardstick allowable assigned to water floods.

Capacity allowable policy for secondary water floods in Texas has been in effect for 8 years. Experience during this period shows that water-flood allowables in excess of prorated levels are an insignificant factor in our present oversupply problem. The reason is apparent from an examination of a typical water-flood performance curve. The peak producing interval is a relatively brief period during the life of a flood. Within a field, progressive development has generally occurred at a rate such that oil production from some floods are declining while others peak, so that the field secondary oil-producing history is similar to its primary history, noting that where secondary reserves substantially **exceed** primary reserves, the secondary peak will be higher as would be anticipated.

The performance of South Ward field, Ward County, Texas, illustrates this experience. The performance chart, Fig. 1, reflects that the secondary oil-production peak exceeds the primary peak by only one-third, even though secondary reserves will probably exceed primary reserves by 100% or more. Proportionate to indicated reserves, the secondary peak under capacity flooding is actually lower than the primary peak.

Certainly if South Ward field, with its spectacular flooding potential, exhibits a relatively moderate secondary peak, then average field flooding performances will generally yield peaks comparable to those of primary histories. It is apparent that while over-all water-flood production will increase with time, that fraction of water-flood production in excess of prorated levels will remain a transient figure, primarily dependent upon the rate of development which occurs in the fill-up time interval immediately preceding the period under consideration. In other words, the new floods account for most allowables in excess of prorated levels. It is obvious that if a large fraction of water-flood production occurred at rates exceeding prorated levels, the average per well water-flood allowables would be considerably higher than shown in Table 1.

2. Water-flood production in Oklahoma

WATER FLOODS have been subjected to proration by the Oklahoma Corporation Commission on two occasions. First occurrence was during June and July 1954, when the commission limited all water-flood projects to a pool-wide or project-wide allowable, determined by multiplying 20 bbl. per well per day by the number of producing and input wells completed in the common source of supply under flood. As shown later in this discussion, proration of this type and magnitude would affect only a few of the state's projects, for at any one time less than 5% of the projects are capable of producing in excess of 20 bbl. per day per well.

Second and latest occurrence of state-imposed water-flood proration occurred in March 1958. In this instance water floods, as well as all other types of primary and secondary oil production, were allowed to produce during March an amount equal to 89% of the pipeline runs in January 1958. This type of proration order (issued on the first day of the subject month) affected all water-flood projects and, in many instances, necessitated the immediate reduction of injection rates.

Water-flood operators with floods having an increasing oil-production rate who could show that curtailment of injection and producing rate would cause loss of ultimate recovery, were allowed to present their cases in an informal meeting with the Corporation Commission. Many operators accepted this opportunity and in most cases the commission granted the increased allowables requested.

In late March 1958, during the reg-

ular monthly market-demand hearing to set the allowable for April 1958, many operators presented data and expert testimony showing losses of producing capacity and ultimate oil recovery caused by imposed restriction in injection rates. The weight of evidence and testimony by water-flooding experts resulted in the commission's removal of water-flood proration from the April proration order.

Procedure

Water-flood projects may be initiated and operated only upon notice, hearing, and issuance of order by the Oklahoma Corporation Commission. The operator of each such authorized project is required to file a monthly report on each project showing, among other data, the area encompassed by the project, the number of water-injection and oil-producing wells, the average daily volumes of water injected and oil and water produced, and the operator's estimate of the minimum and maximum efficient rate of production of the project. Crude-oil purchasers are not permitted to run crude from a project until and unless the commission has received such report for the previous month.

In the spring of 1957, the commission prepared a tabulation of the pertinent data shown on the March 1957 reports of water-flood projects in the state. A similar tabulation of the same data for January 1958 was made for presentation in this paper.

As a result of strict pollution regulations, hearings are required to obtain permits for underground disposal of produced water. Many operators who plan to dispose of produced water by injection into the common source of supply, request a water-flood permit instead of a salt-water disposal permit. An operator, therefore, can produce the project at capacity rates because authorized water floods (unlike salt-water disposal systems) are permitted to produce at capacity. For this reason many of the so-called water-flood projects in Oklahoma, for which monthly reports are tendered to the commission, actually are salt-water disposal projects. Any attempt to analyze the monthly water-flood reports to ascertain the status of water-flood production, must incorporate some method of eliminating the disposal projects operating under the guise of true water-flood projects.

In an attempt to arrive at statistics representing true water-flood projects, a similar yardstick has been used to define salt-water-disposal projects —those projects reporting fewer than two input wells are considered to be disposal projects and not "true" water floods. Some true flood projects on small leases which contain only one input well may have been deleted, and similarly, some disposal projects containing two or more disposal wells may have been included in the data obtained in this manner.

There are included in the remaining true water-flood tabulation many high-producing-rate projects which are actually pressure-maintenance projects; however, no attempt has been made to delete the pressure-maintenance projects from the tabulation since an intimate knowledge of all projects in the state would be required to accurately classify each project.

In the March 1957 data, 467 projects were in operation, of which 123 (26.3%) reported fewer than two input wells and, therefore, were deleted from the tabulation. Of the 480 projects reported in January 1958, 123 (25.6%) were deleted. Many of the deleted projects reported "zero" input wells and "zero" water injection.

Having deleted the disposal projects, an analysis of the remaining water floods was made for the two reporting periods. The results of those analyses are shown in Table 2.

Of particular significance is the fact that during the March 1957 and January 1958 periods analyzed, the average daily oil-producing rate of the oil wells was 7.49 and 7.96 bbls., respectively, and the average daily oil-producing rate of total of oil and input wells was 4.39 and 4.76 bbl. respectively. These statistics disprove the often-heard charge that unrestricted production of water floods deprives other types of production of a fair share of the state's total allowable. Those persons who make such statements often claim that water floods are not rate sensitive, and that injection and producing rates may be varied at will without impairing ultimate recovery. Usually, they propose that water floods, like primary production, should be prorated on a per well basis. The most frequently suggested plan would allocate to each input and oil well in a project a per well allowable equal to the allowable given a primary well of like depth.

Primary well allowables in Oklahoma increase with depth; however, the minimum basic allowable imposed upon even the shallowest well usually is 20 bbl. per day. If the depth yardstick is disregarded in setting the allowable of a water flood, and the minimum basic allowable of 20 bbl. per day is given to each oil well and each input well in an authorized project, the March 1957 data show that only 27 (7.8%) of the projects were producing more than 20 bbl. per day per total well. The amount of daily production in excess of 20 bbl. per day per total well was 5,755 bbl. Thus, if water floods had been prorated on that basis during March 1957, there would have been only 5,755 bbl. per day, or 0.92% of the state's total allowable available for allocation to other types of oil production.

Similarly, in January 1958, only 17 (4.8%) of the projects were producing more than 20 bbl. per day per total well. If these 17 projects had

TABLE 2—SUMMARY—TRUE WATER-FLOOD PROJECTS IN OKLAHOMA

	March 1957	January 1958
Total state allowable, B/D	625,000	562,000
True water-flood production, B/D	115,570	127,771
True water-flood production, per cent of total allowable	18.5	22.7
Total number of true water-flood projects	344	357
Area under authorized water-flood, acres	208,758	244,668
Total water injected, B/D	1,516,359	1,630,086
Total water produced, B/D	Unknown	863,910
Number of oil wells	15,427	16,053
Number of water-input wells	10,881	10,865
Average oil production per oil well, B/D	7.49	7.96
Average oil production per total of oil and input wells, B/D	4.39	4.76

been prorated at 20 bbl. per day per total well, there would have been only 10,359 bbl. per day, or 1.8% of the state's total allowable, available for allocation to other types of oil production.

Table 3 shows, by range, the number of projects producing in excess of 20 bbl. per day per total well, and the amount of daily production in excess of 20 bbl. per day per total well.

The majority of the projects as shown in Table 3, producing in excess of the state's minimum allowable, are producing no more than 29 bbl. of oil per day per total well. If the depth yardstick would be employed, many of the projects in the 20 to 29 bbl. of oil per day per total well range, as well as most of the projects producing in the higher range, would not be producing at rates above yardstick allowable. Some of these high-rate projects also could more reasonably be classified as pressure - maintenance projects. A part of the oil being produced from these projects should be considered as primary oil and not true secondary-recovery oil. Also, it is probable that most of the other high-rate projects are at their peak rates of production—rates that last for a very short period of time.

Oklahoma summary . . . From the foregoing analysis of water-flood oil production in Oklahoma, it may be concluded that:

1. Capacity water-flood production, while accounting for some 18 to 22% of state's total market demand, is not getting more than its fair share of the total market.

2. During any calendar-month period, a very small percentage of the water-flood projects will be producing at rates in excess of the state's usual minimum well allowable of 20 bbl. per day and the daily amount of oil produced in excess of the minimum allowable by these few projects is less than 2% of the state's total daily production.

3. If water floods were prorated at 20 bbl. per day per well, in order to restrict only the few projects operating at their short-lived peak producing rate, the amount of oil available by this curtailment, if allocated to other types of producing wells in Oklahoma, would amount to only a small fraction of a barrel per day per well.

4. There is a great need for the Oklahoma Corporation Commission, as well as for all state regulatory bodies, to differentiate between true water floods in primary depleted pools, pressure-maintenance projects, and salt-water-disposal projects.

TABLE 3—OKLAHOMA WATER-FLOOD PROJECTS PRODUCING IN EXCESS OF 20 BBL. PER DAY PER WELL

Range, bbl. per day per total well	March 1957		January 1958	
	No. of projects	Daily oil production in excess of 20 bbl. per day per well	No. of projects	Daily oil production in excess of 20 bbl. per day per well
80-89	...	...	1	1,035
70-79	...	...	...	...
60-69	...	...	...	...
50-59	...	...	3	2,913
40-49	4	1,295	...	...
30-39	6	2,552	3	1,313
20-29	17	1,908	10	5,098
Total	27	5,755	17	10,359

TABLE 4—ECONOMIC STATISTICS BY YEARS FOR OKLAHOMA FLOOD NO. 1

(Per barrel)

Year	Income	Lifting cost	Development cost	Total cost	Profit and loss
1936	$1.114	$0.200	$0.248	$0.448	$0.666
1937	1.236	0.435	0.051	0.486	0.750
1938	1.210	0.675	0.029	0.704	0.506
1939	1.036	0.610	0.185	0.425	0.611
1940	1.032	0.716	0.077	0.639	0.393
1941	1.118	0.912	0.098	1.010	0.108
1942	1.176	1.262	0.087	1.349	0.173
1943	1.179	0.514	0.001	0.515	0.664
1944	1.298	0.580	0.091	0.489	0.809
1945	1.516	0.973	0.357	0.616	0.900
1946	1.596	1.117	0	1.117	0.479
1947	1.920	1.395	0.216	1.611	0.309
1948	2.581	1.537	0.839	2.376	0.205
1949	2.568	1.771	0.561	2.332	0.236
1950	2.570	2.423	0.811	3.234	(0.664)
1951	2.570	2.607	0.130	2.737	(0.167)
1952	2.570	2.132	0.635	2.767	(0.197)
1953	2.707	2.338	2.210	4.548	(1.841)
Abandoned					

TABLE 5—ECONOMIC STATISTICS BY YEARS FOR OKLAHOMA FLOOD NO. 2

(Per barrel)

Year	Income	Lifting cost	Development cost	Total cost	Profit and loss
1938	$1.069	$0.887	$6.874	$7.761	($6.692)
1939	1.040	0.248	0.116	0.364	0.676
1940	1.039	0.225	0.018	0.243	0.796
1941	1.129	0.310	0.005	0.315	0.814
1942	1.190	0.388	0.004	0.384	0.806
1943	1.178	0.516	0.009	0.525	0.653
1944	1.287	0.574	0.015	0.589	0.698
1945	1.516	0.958	0.045	1.003	0.513
1946	1.605	1.129	0.147	1.276	0.329
1947	1.912	1.393	0.021	1.414	0.498
1948	2.581	1.538	0.025	1.513	1.068
1949	2.568	1.776	0.027	1.803	0.765
1950	2.570	2.344	0	2.344	0.226
1951	2.570	2.654	0.037	2.691	(0.121)
1952	2.570	2.148	0.054	2.202	0.368
1953	2.707	2.382	0.262	2.120	0.587
1954	2.820	2.628	0.492	2.136	0.684
1955	2.820	6.374	0.722	5.652	(2.832)
Abandoned					

3. Some economic aspects of water flooding

ONE OF THE most important subjects, but also one of the most neglected subjects as far as the literature is concerned, is the economics of water flooding. No operator of a water flood can ignore this subject if he wants to be successful. The relationship between economics, rate of production, and ultimate recovery of water-flood oil is a large and complex problem. The intention of the discussion here is to introduce the subject and mention some of the aspects of it. A more complete development of this subject will be forthcoming in future papers.

TABLE 6—ECONOMIC STATISTICS BY YEARS FOR OKLAHOMA FLOOD NO. 3
(Per barrel)

Year	Income	Lifting cost	Development cost	Total cost	Profit and loss
1937	$1.241	$0.291	$3.096	$3.387	($2.146)
1938	1.184	0.188	0.392	0.580	0.604
1939	1.040	0.207	0.191	0.398	0.642
1940	1.040	0.252	0.202	0.454	0.586
1941	1.128	0.382	0.134	0.516	0.612
1942	1.185	0.462	0.006	0.456	0.729
1943	1.184	0.632	0.002	0.634	0.550
1944	1.316	0.735	0.067	0.802	0.514
1945	1.512	1.023	0.019	1.042	0.470
1946	1.603	1.082	0.094	1.176	0.427
1947	1.917	1.351	0.156	1.507	0.410
1948	2.573	1.613	0.048	1.661	0.912
1949	2.528	2.087	0.069	2.156	0.372
1950	2.570	2.838	0.399	3.237	(0.667)
1951	2.570	3.497	0.539	4.036	(1.466)
1952	2.570	2.601	0.986	3.587	(1.017)
1953	2.707	0.570	14.311	14.881	(12.174)
Abandoned					

TABLE 7—ECONOMIC STATISTICS BY YEARS FOR OKLAHOMA FLOOD NO. 4
(Per barrel)

Year	Income	Lifting cost	Development cost	Total cost	Profit and loss
1939	$1.029	$3.261	$17.659	$20.930	($19.891)
1940	1.039	0.280	0.127	0.407	0.632
1941	1.114	0.356	0.018	0.374	0.740
1942	1.172	0.691	0.326	0.365	0.807
1953	1.178	0.512	0.018	0.530	0.648
1944	1.295	0.579	0.535	1.114	0.181
1945	1.515	0.909	0.132	1.041	0.474

TABLE 8—ECONOMIC STATISTICS BY YEARS FOR OKLAHOMA FLOOD NO. 5
(Per barrel)

Year	Income	Lifting cost	Development cost	Total cost	Profit and loss
1940	$1.029	$0.853	$2.302	$3.155	($2.126)
1941	1.152	0.338	0.250	0.588	0.564
1942	1.183	0.282	0.133	0.415	0.768
1943	1.196	0.660	0.091	0.751	0.445
1944	1.337	0.772	0.088	0.860	0.477
1945	1.510	0.866	0.112	0.978	0.532
1946	1.600	0.778	0.034	0.812	0.788
1947	1.906	1.011	0.002	1.013	0.893
1948	2.581	1.375	0.009	1.366	1.215
1949	2.572	1.581	0.004	1.585	0.987
1950	2.570	3.416	0.382	3.798	(1.228)
1951	2.570	1.137	0.342	1.479	1.091
1952	2.570	4.772	0.135	4.907	(2.337)
Abandoned					

Water floods are not all economic successes or even physical successes. Most operators do not like to present facts and figures about their failures. The risk element is present in water flooding and some ventures have been very expensive indeed. Warren L. Baker,[4] states this risk factor very well:

"The industry needs to come to think of water flooding in terms somewhat similar to the way it views wildcat operations.

"Oil operators do not expect all wildcat wells to discover production. They know many wildcats will be dry.

"On the other hand, too many operators seem inclined to expect every water-flood operation to be profitable. This is expecting too much. There will always be some unsuccessful floods, and operators should not turn their backs on water flooding because some projects fail."

Development Costs

The cost of developing a water flood will depend upon many factors such as the usefulness of existing wells, spacing, water requirements, water availability, pressure requirements, and water-treating equipment. In general the present average cost of development of a project will range from about $0.25 per barrel of oil produced to over $1.00 per barrel. Some year-by-year development costs of representative water floods which are now abandoned will be found in Tables 4 through 8. The development cost figures of these five Oklahoma water floods do not include acquistion costs.

Operating costs can be figured many different ways but they always should include the full cost of producing oil. The administrative overhead charges may or may not be included in these costs. In the data presented in Tables 4 through 8 the administrative overhead figures are not included. The real problem, however, is in the interpretation of the real value of the cost figures which are prepared for a water flood that is in operation for 15 or more years. In that period of time the price of oil and the costs can vary by several hundred per cent. For this reason the average per barrel cost is of little meaning unless it is referred only to economic climate of the specific years in which the flood was operated—and even then it is difficult to determine what a dollar was worth and arrive at correctly weighted average data for a long span of years.

Charles R. Dodson,[5] states—"Although costs and taxes on oil production may be currently from 15 to 20% of the posted price and appear to

TABLE 9—LIFTING COSTS AS PER CENT OF INCOME BY YEARS AFTER START OF FLOOD

Years	Oklahoma floods					Average of five Oklahoma floods
	No. 1	No. 2	No. 3	No. 4	No. 5	
1	18	83	23	317	83	105
2	35	24	16	27	29	26
3	56	22	20	32	24	31
4	59	27	24	59	55	45
5	69	33	34	43	58	47
6	82	44	39	45	57	53
7	107	45	53	60	49	63
8	44	63	56		53	54
9	45	70	68		53	59
10	64	73	67		61	66
11	70	60	70		133	83
12	73	69	63		44	62
13	60	91	83		*186	78
14	69	103	110			94
15	94	84	136			105
16	101	88	101			
17	83	93	21			
18	86	226				

*Not used in average.

provide a wide margin of profit, a different situation exists when 60 to 80% of one price is pledged or needed to service debt."—Dodson has a reasonable approach to the evaluation of operating costs because it is well known that costs and crude-oil prices vary together, assuming there is a fairly constant demand for crude oil, equipment and services.

Table 9 shows lifting costs as per cent of income by years for each year of operation of the five Oklahoma water floods which have been studied. Immediately it will be observed that lifting costs as per cent of income are very much higher than the range mentioned by Dodson. This is not surprising to anyone who works with water flooding. The per barrel operating or lifting costs for a water flood continually increase after peak oil production is reached. This can be understood readily when one considers the nature of water flooding.

The cost of injecting water and lifting produced water with the oil is the basic reason for the high cost of operation. All pumping facilities in a normal water flood are required to lift the same total production as was lifted at the time of peak production for all years following peak oil production. This is not the case in all primary producing operatings. Dodson's figures for the relation between lifting costs and income must have referred to primary producing operations where costs per barrel can be much lower than in the case of water floods.

The cost of finding oil should not be overlooked in a discussion of water-flood economics. Carter Oil Co. reports a cost analysis for the Illinois basin area. Almost 50% of the oil produced in this area is from water flooding. Carter economists report[6] "The cost of replacing a barrel of Illinois basin oil is greater than the posted crude price for the area." . . . "The cost (of finding oil) rose from 16 cents per barrel (12% of income) during the war year 1942 to $1.45 (45% of income) in 1956. This includes full credit for water-flood oil from reservoirs found during the period." . . . "Development costs rose from 29 cents (21% of income) per barrel to 60 cents (20% of income) between 1942 and 1956 and operating costs rose from 33 cents (24% of income) to $1.00 (34% of income) during the 15-year period." . . . The Carter report does not specifically separate the water-flooding costs from primary production costs, but when one considers that almost half of the oil produced in the Illinois basin area in 1956 was from floods, it can be seen that water flooding there has not resulted in high-profit oil production.

These considerations lead to the subject of the relation between rate of production, costs, and ultimate oil recovery. Put directly, if the water-flood operator does not receive an early return of his investment dollars, he cannot afford to obtain his oil by operating at necessarily high lifting costs over an extended period of years, and he will, therefore, leave oil in the reservoir due to prematurely reaching economic limit.

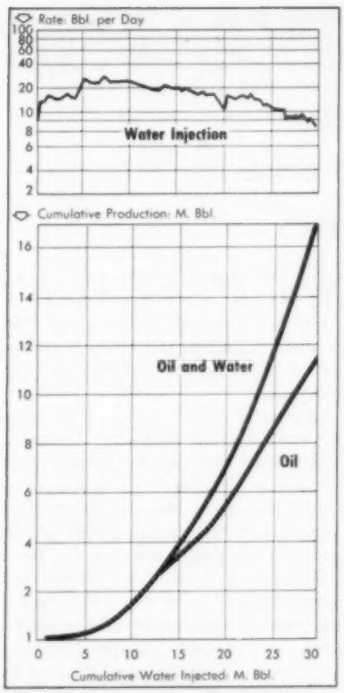
It is not necessary to prove a physical loss of oil by low production rates in water floods (although this can be proven, too) in order to show wasted oil at the low rates of production. Any oil not obtained before the economic limit of a water flood is lost oil and not subsequently recoverable at a profit. If any of this oil could have been obtained profitably by higher rates of production, the amount which could have been so produced is wasted by the low rates of production. This relationship between rate of production and ultimate recovery can be clearly shown by analyses of flood results. This is a comprehensive subject and it will be developed more fully at a later time to show the magnitude of the wasted oil at low rates of production in water floods.

4. Analyzing flood field data

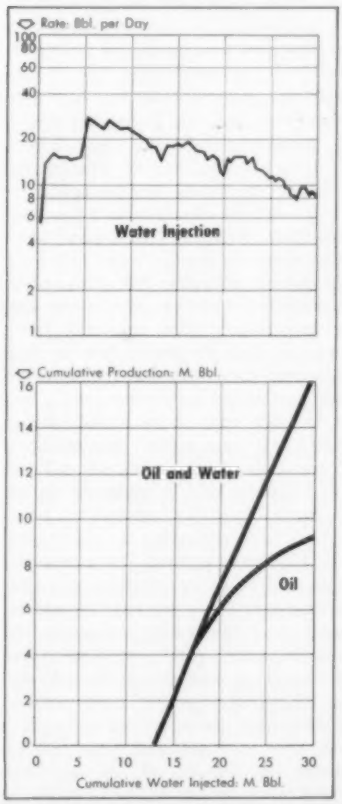
JORDAN, McCardell, and Hocott,[1] in their discussions of the subjects of evaluation of water-flood performance and analyses of field data, evaluated oil-production performance in water floods by plotting cumulative oil production (or oil and water production) versus cumulative water injected. They showed a number of these plots including several from C. R. Fettke's[7] published data. Their Figs. 5, 6, and 41 are reported to be Fettke's D-Unit, B-Unit, and C-Unit of Flood No. 29, and are presented as typical water floods in Bradford field. Reference to Fettke's book will show that Flood 29 is not located in Bradford field, but is in Burning Well pool about 6 miles east of Kane. In addition these three units of Flood 29 each consist of only one producing well, which is at the center of a 2-acre five-spot. The producing wells in D-Unit and C-Unit were drilled about a year after water was first injected into the input wells. Delayed drilling of this type is not typical of Bradford field operations.

The method chosen by Jordan, McCardell, and Hocott to evaluate water-flood performance has some definite limitations, the principal one being the scale values of cumulative data. In the plotting of cumulative data almost any curve appears to be smooth when large numbers are plotted on a small sheet of paper. When these curves are plotted on large sheets of paper, many deviations are observed which are significant in water-flood performance, but which are not detected in curves of the size presented on a printed page.

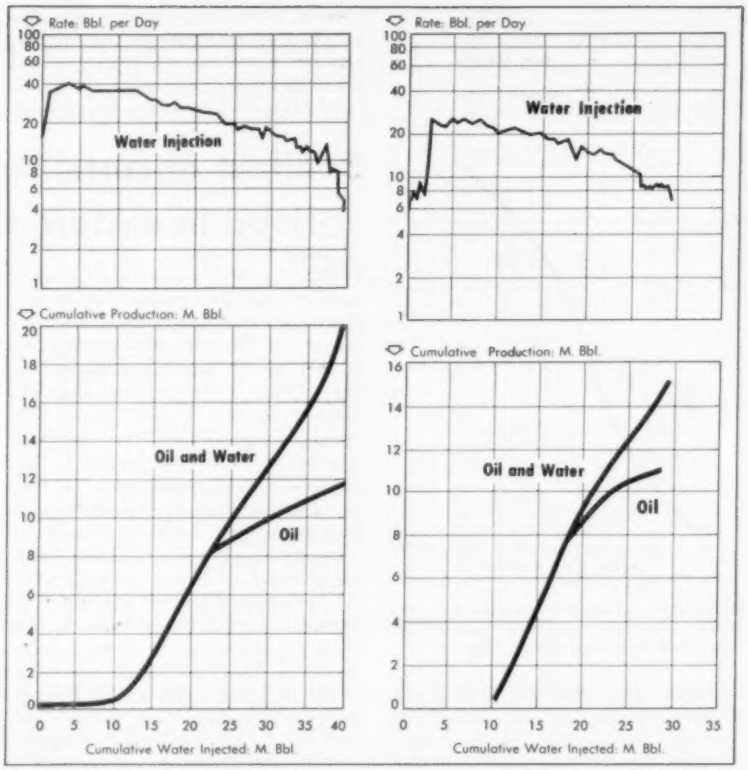
The individual five-spots chosen by



RELATION between fluid production and water injection, one well in Burning Well pool, near Kane, Pa. Fig. 2.



RELATION between fluid production and water injection, Bradford field floods. This was Fig. 6 of Jordan, McCardell, and Hocott (Reference 1). Fig. 3.



RELATION between fluid production and water injection, Bradford field floods. This was Fig. 41 of Jordan, McCardell, and Hocott (Reference 1). Fig. 4.

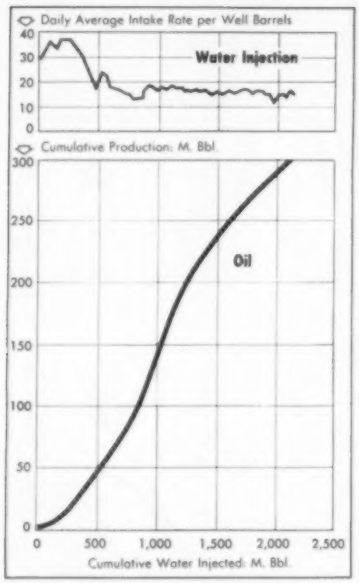
Jordan, McCardell, and Hocott happened to fit their argument which is quoted[8] here.

"In each of these examples, at fill-up, a linear relation exists between the amount of water injected and the amount of oil produced. After water production began, the total fluid produced continued to increase more or less linearly with injection. However, the oil rate declined as the produced water-oil ratio increased.

"In these floods, fluctuations in rate of injection did not disturb the relation between the injected and produced fluids despite threefold to tenfold changes in injection rate during the history of the projects. As observed from the smoothness of the oil curve, the volume of oil produced as a result of injecting a unit volume of water was not dependent on the rate at which the water was injected. Thus the changes in injection rates had no detectable effect on the flood performances or on the ultimate recoveries."

Individual five-spots can be chosen to show a different picture. From Fettke's data on Flood 29 another five-spot, A-Unit, located on the map directly between C-Unit and D-Unit, was chosen and the data plotted in the same manner as Jordan, McCardell, and Hocott. This is presented as Fig. 2. It will be noted that the oil-production behavior does not follow the description as given in the above quotation. Instead the oil production continues to increase more or less linearly with injection and does not decline in the manner of the other wells on either side of it. For reference Jordan, McCardell, and Hocott's[1] Figs. 6 and 41 are repeated here as Figs. 3 and 4. Can it be possible that the performance of A-Unit is an exception to other wells chosen by Jordan, McCardell, and Hocott and to all other wells in the project? It can be misleading to use individual well data to demonstrate typical waterflood behavior.

A number of full-scale Bradford field water floods are reported by Fettke.[7] One of these is his Flood No. 20 on pages 368-370. This flood during its first 5½ years of operation produced 309,000 bbl. of oil by the injection of 2,267,000 bbl. of water. A plotting of cumulative oil produced versus cumulative water injected and a curve of daily average water intake rate per well are presented in Fig. 5. The oil-production behavior of this flood also is contrary to the theory and examples presented by Jordan, McCardell, and Hocott. Observe the steep increase in oil production rate after about 900,000 bbl. of water were



RELATION between oil production and water injection, complete water-flood project in Bradford field. Fig. 5.

injected. This increase is so pronounced in the case that cumulative plotting does not iron out the change of rate of oil production. Jordan, McCardell, and Hocott state[9]

"The greater the slope of the oil curve, the more effective is the flood. If rate influences recovery of oil, any significant change in rate should result in a change in slopes of these curves."

If this quotation is a correct conclusion, we certainly should decide that Flood 20 is an example of rate influencing recovery. On the other hand other conditions not reported by Fettke or the invalidity of the general statement quoted may alter the conclusion. It does not appear that the approach taken by Jordan, McCardell, and Hocott is proof of field performance any more than any other type of presentation of data.

In this discussion we conclude that each method of plotting data of water-flood performance has its own limitations. No methods commonly used in the industry are in themselves wrong, and none are exclusively superior to all others. The problem of evaluating water-flood behavior goes beyond the techniques of presenting the data. Correct data may be interpreted a number of different ways, but the manner in which it is plotted cannot itself determine the interpretation. If one desires to minimize the effect of the changes in rate, the plotting of cumulative rate data will be the best method to use because of the large scale values necessary.

The plotting of cumulative water injected versus cumulative oil produced does demonstrate the relation between these two variables, but the use of this type of curve for evaluation of ultimate oil recovery or for showing rate changes is not superior to the usual rate-time or rate-cumulative curves which are readily understood because they have been in use for many years.

5. Effect of curtailment on a flood in eastern Kansas

JORDAN, McCardell, and Hocott[1] used production graphs which had been submitted to the Railroad Commission of Texas by Forest Oil Corp. at their South Ward hearing in January 1950. Two of these were for leases in eastern Kansas. Hocott and coauthors made their own reevaluation of these curves presented in their paper as Exhibits 42 and 44.[10] In their reevaluation they attempted to show that there had been no loss in oil recovery as a result of curtailment of water injection. Fig. 42 of their paper is a production decline curve for the Lynde, Walter & Darby lease "C" and their Fig. 44 is for the Lynde, Walter & Darby lease "A". These two leases are now being operated by Chanute Property Management Corp., Inc., and, together with 27 additional leases, include practically the entire area of an oil pool located east of Chanute, Kan.

The composite oil-production and water-injection curves for the entire group of leases including lease "C" and lease "A" referred to by Hocott and coauthors is presented here as Fig. 6. One of their main contentions in evaluating a curve for an individual lease has been that even though oil might have been lost from said lease, it must have been recovered from adjacent leases.

Now we have an opportunity to look at total pool performance and evaluate the results of curtailment by examination of the data shown in Fig. 6. Specific attention is called to the sharp reduction in water-injection rate in July 1951 as a result of the Neosho River's flooding and again in October and November 1953, as a result of a proration order issued by the Kansas Corporation Commission. Following the curtailment in July 1951, injection rate was decreased from 20,000 bbl. per day in June to 13,000 bbl. per day in July, and then restored to 20,000 bbl. per day by October.

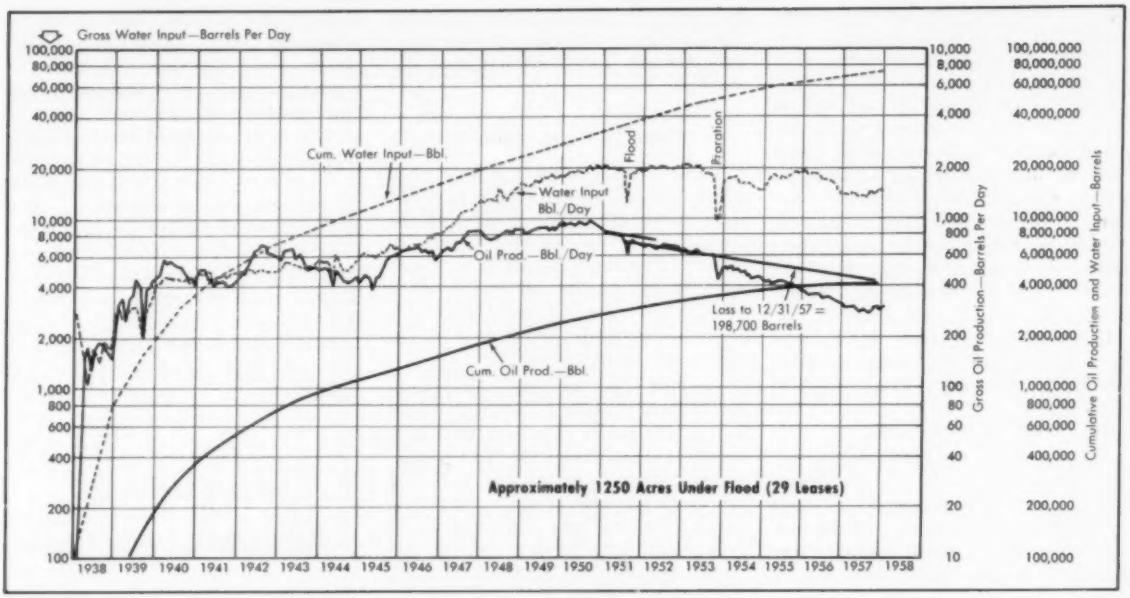
It is noted that the oil-production rate dropped from 800 bbl. per day in June to 610 bbl. per day in July and thence increased only to about 750 bbl. per day in September after injection rates were increased. An extrapolation of the oil rate trend from January through June compared with actual production rate after August clearly indicates a loss in oil rate of about 60 bbl. per day. The rate of decline following the interruption was the same as before and there is no indication that the "lost oil" would be recovered.

An even greater loss in oil production and ultimate recovery, however, was sustained following curtailment of injection in October 1953. In September of that year the oil production rate was 620 bbl. per day and, as indicated by the curve, the rate had been on a constant percentage decline for approximately 2 years. Water-injection rate in September was approximately 19,000 bbl. per day. In October, injection rate was decreased to about 9,500 bbl. per day and oil production rate to 440 bbl. per day to comply with the state proration order. In the latter part of November, proration was lifted and by December the injection rate was increased to 17,500 bbl. per day—the maximum which could be attained following the curtailment period. In December 1953, the oil-production rate increased to 520 bbl. per day, but by March had definitely started to decline again.

An extrapolation of the 2-year decline trend prior to curtailment compared with the decline trend following curtailment indicates that a loss of at least 80 bbl. of oil production per day was sustained. This amounts to a minimum loss of 100,00 bbl. to date while the area between the extrapolated and actual curves indicates a loss of 199,000 bbl. It is impossible to make any reasonable interpretation of the curves which would indicate other than a loss in ultimate oil recovery.

Also, it is interesting to note that it was not even possible to attain the same level of water injection rate after curtailment. Early in 1955, however, under new operating personnel, the water-injection rates were increased by reworking several inputs. Although the increased injection rates resulted in some increase in rate of oil production, they did not and have not regained the loss in oil recovery sustained as a result of curtailment in 1953.

Inasmuch as this total pool curve so clearly reflects a loss in oil recovery as a result of curtailment, it was

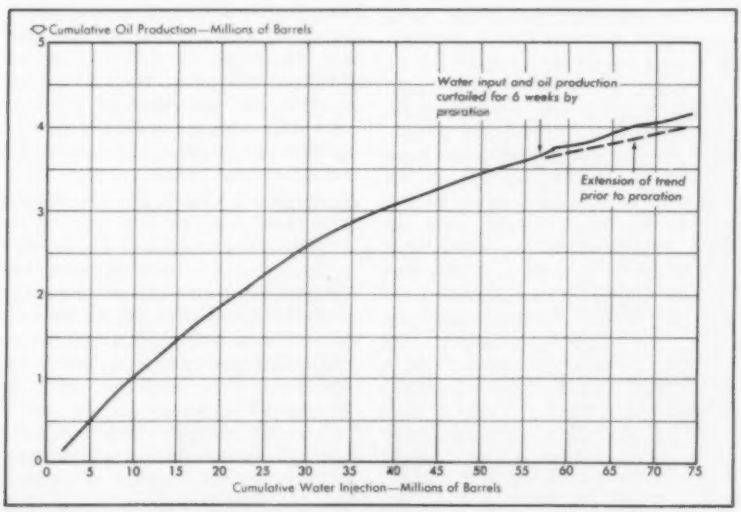


PRODUCTION and injection data for 29 leases of Chanute Property Management Corp., Inc., water-flood project in eastern Kansas. Fig. 6.

deemed desirable to construct a valuation curve of the type used by Jordan, McCardell, and Hocott. This was done by plotting cumulative oil production versus cumulative water injection as shown in Fig. 7.

This is the same type of plot which Hocott and coauthors used so freely in their paper to try and prove that rate had no effect on ultimate recovery. The trend of the curve in Fig. 7 prior to curtailment in 1953 has been extrapolated as shown by the dashed line. A comparison of the extrapolation with the actual curve would indicate that the curtailment had resulted in an increase in ultimate oil recovery. However, **it is evident without argument from Fig. 6 that there was no gain in oil recovery, but rather a loss.** This comparison readily illustrates that a plot of cumulative oil versus cumulative water is not a valid tool to evaluate ultimate oil recovery. All a plot of this type shows is the relationship of water injected to oil produced.

With reference to Fig. 6, a study has been made of each of the 29 individual lease curves for the purpose of evaluating effect of curtailment in 1953. Insofar as the individual curves are concerned, only 11 out of the 29 reflected an identifiable loss of oil production amounting to 50 to 60 bbl. per day as a result of curtailment. This is because some leases did not sustain a loss large enough to be detected. From this, it might very well be concluded that the loss in oil recovery as reflected by a single lease curve may be appreciably less than that reflected by the performance of a total pool.


Cumulative Oil Production—Millions of Barrels
Water input and oil production curtailed for 6 weeks by proration
Extension of trend prior to proration
Cumulative Water Injection—Millions of Barrels

RELATION between oil production and water injection for 29 leases of Chanute Property Management Corp., Inc., water-flood project in eastern Kansas. Fig. 7.

6. Pressure in water-flood recovery

ANY SYSTEM that can revive a depleted oil field is the ultimate in petroleum conservation and the prevention of waste of this natural resource. Any procedure, regardless of motive, that would result in the ultimate loss of oil production would be the opposite.

The consensus today among water-flood operators is that a successful water flood must be a continuous uninterrupted operation. Any discontinuance of the flood will result in immediate and ultimate loss of oil, whether the interruption is caused by mechanical difficulties or by arbitrary regulation. Operators and water-flood engineers, through experience, (and the thinking is almost unanimous) have come to the conclusion that the most oil will be produced by a pattern flood having the highest pressure drop from the high-pressure areas to the low-pressure areas within the pattern. This can be accomplished only by having the highest safe pressure at the

injection wells and the lowest pressure possible at the producing wells.

At present we have a controversy on this subject. Several learned scientists and laboratory technicians flatly state that the rate at which water penetrates and floods out an individual piece of oil formation has no relationship to the ultimate oil recovery from that piece of formation. At first glance, we might assume that if one school of thought is right then the other must be wrong. At second glance, because of the integrity and intellectual caliber involved, it must be conceded that both parties can be correct in what they have observed.

Pros and Cons

In the first place, the operators are absolutely correct in their contention that interrupted, prorated, or low-pressure floods produce less ultimate oil than uninterrupted high-pressure floods. Too many case histories have proved this to be correct. Too many floods have been plugged and abandoned as failures because of low ineffectual injection rates. Salvage operations on some of these failures have resulted in a financial gain, but in every case there is a failure, at least in degree.

On the other hand, the laboratory technician observes that the rate at which water passes through a saturated core or simulated piece of oil formation in the laboratory has little or no effect on the amount of oil extracted from the core. He concludes then, and states, that rate of water injection has no significance in the field as far as ultimate oil recovery is concerned. There may be some major discrepancies in the character of laboratory specimens as compared to bottom-hole conditions. This may be particularly true as concerns wettability. That subject, however, will not be dealt with here.

It will be noted that in all theoretical assumptions, and in all laboratory experiments, the cores or simulated pieces of oil formation are actually flooded. In other words, water penetrates the core and displaces oil. The logical explanation which can resolve the controversy is that only a portion of the pay formation is flooded in the field when low volumes of water are injected through wells at correspondingly low pressures. Since the permeability range in all known oil formations is high, we may safely state that the amount of pay formation receiving the injected water is in direct proportion to the pressure applied. This observation is at variance with the generally accepted idea that the rate of penetration is in direct proportion to the permeability. Where there is no movement of fluid, there is no rate. This has been observed in two manners in many Yates sand floods in the Permian basin.

Where Is Water Entering?

Various types of surveys have been taken in water-injection wells to determine where the water is entering the formation. These surveys invariably show that at low pressure only a portion of the known oil pay sand is actually taking water. As the pressure is increased, more of the pay formation starts taking water.

Another type of observation concerns newly drilled injection wells where the entire pay sand section is known to have relatively low permeability. Many of these wells will take no water whatsoever until pressure at several hundred psi. is applied at the well head. The porosity of the pay sand in these wells is relatively high, averaging in many instances as much as 23%. The oil content is almost as high as that in wells with much higher permeabilities.

All wells, including those having pay zones of high permeability, also have tight sand sections comparable to those in the wells mentioned. It is evident that these tight sand sections will not take any water until the applied pressure reaches that required for the same permeability of the low-permeability sand wells. This poses the question as to what takes place if injection rates are regulated by volume. It is possible that only the highly permeable streaks will take the water in some wells while the entire pay section may take water in the low-permeability wells.

Several floods in Permian sands have been regulated by volume at fixed low injection rates. These rates were set at so many barrels per well per day or barrels per calculated acre-foot of pay formation per day. This resulted in very low injection pressures. In some instances water was injected at an unknown hydrostatic head pressure. The results from this method of operation were what could be expected. The water flooded only the highly permeable zones. When these high permeability sands flooded out, the producing wells rapidly approached a 100% water cut. Some of these floods were abandoned as failures. Others were revived at a later date as a result of the experience gained from other floods which were conducted at higher rates and pressures. These salvage attempts were successful in that they were able to return a profit. In every instance of salvage attempts, water cuts increased from the beginning and none recovered the ultimate volume of oil produced from comparable leases which were flooded originally at higher pressures. It is hazardous then to assume that pressures can be progressively increased in an attempt to maintain fixed rates of production.

It can be stated in conclusion of this subject that a curtailment of rates of injection or production in a water flood will result in a reduction of pressure drop in the producing formation. This in turn will result in bypassing the tighter pay zones with a loss of ultimate oil recovery. Additional field data will be presented to support these conclusions.

7. Discussion of laboratory studies

PUBLISHED information regarding the application of present theories of reservoir mechanics to water injection recognizes two different processes which, it is alleged, could cause water floods to be rate sensitive. The first of these is the effect of gravity segregation of water and oil in the flooding operation. Gravity segregation could cause decreased oil recoveries at lower rates of water injection. The second of these is the effect of capillary pressure which has been alleged to cause higher recoveries at lower rates of water injection. There is, however, among research personnel, a divergence of opinion on the magnitude of these effects in the field.

Water, because of the fact that it is heavier than oil, has a tendency to underrun oil. This tendency, if pronounced, could result in lower oil recovery than would be anticipated if this factor were neglected. A considerable amount of laboratory work has illustrated this point. All other factors being equal, however, as injection rates are increased it has been recognized that gravitational effects become less and less important. Richardson and Perkins[11] have concluded from their research that

"Decreasing the rate at which water is injected into a thick homogeneous reservoir sand increases the tendency of water to underrun the oil. This effect becomes noticeable in the reservoir prototype studied in this investigation only at very low rates of advance (0.05 ft. per day or less)." This statement leaves the implication with the reader that it is unimportant in the range of rates encountered in field operation. Craig, Sanderlin, Moore, and Geffen,[12] however, concluded that within the range

of rates normally encountered in water-flooding operations

"... the actual oil recovery at breakthrough of the injected fluid can be from 40% to near 100% of that predicted by methods which assume negligible gravity effects. Thus gravity effects can play an important part in the oil recovery obtained by injection operations in uniform formations."

It can be seen that there appears to be a difference between at least two companies on the importance in actual field operations of gravity which could cause high injection rates to result in increased oil recovery under certain conditions.

All of Humble's research work regarding the effect of capillary pressure on rate sensitivity has been based upon the premise that the great majority of reservoir rocks are completely water-wet. While this assumption in itself has been questioned, even though it is granted, there is still some question as to the actual effect of capillary pressure in the range of rates normally encountered in field operations. In a paper published in May 1957 it was stated[13] without any qualifications

"Curtailment of the rate of production will not reduce ultimate recovery. In fact, in natural reservoirs comprising heterogeneous sands with intercommunicating lenses or strata where capillary effects are significant, reduction in rate of flood advance will probably enhance oil recovery." In December 1957 Dr. Hocott, testifying before the New Mexico Conservation Commission, modified this statement considerably by saying[14]

"I think you can make the general statement that you can't produce them (water floods) at a high enough rate to cause waste."

This would indicate a certain change of emphasis, to say the least, upon the effect of capillary pressure on rate sensitivity over ranges of interest in actual field operations and would appear to relegate capillary pressure effects to the category of something of research interest with little or no practical significance in field operations.

As was stated, there has been considerable question regarding the basic premise underlying Humble's scaling of laboratory models that the majority of reservoirs are water-wet. Dyes, Braun, and Coles in an analysis of a flood in the Permian sands in South Ward field stated[15]

"The core of the first well proved to be weakly water-wet in the laboratory as measured by inhibition tests. The core of the second well was tested at the well site immediately upon removal from the core barrel and confirmed the intermediate wettability."

The intermediate wettability of Permian sands has also been reported by George Buckles in testimony before the New Mexico Conservation Commission. Craig, Sanderlin, Moore, and Geffen stated[16]

"We believe a large portion of reservoir rocks exhibit only moderate wettability preference to either oil or water. The effects of capillary forces on the movement of injected water, as pointed out by Perkins (F. M. Perkins, Jr., Humble Oil & Refining Co.), would be reversed in preferentially oil-wet rocks and are of importance only under strongly water-wet conditions. Actual detailed quantitative information on the lithology and the wettability preference of specific reservoirs is rarely if ever, available. It is doubtful if, under these circumstances, generalization can be made on the effects of capillary forces on the gross movement of injected water in water floods."

In view of the divergence of opinion as to whether natural sands are, to a large extent, completely water-wet or whether they are for the most part of intermediate wettability, the following statement by Jordan, McCardell, and Hocott[17] assumes extreme importance when considering the problem of scaling field conditions to fit laboratory models.

"The fluid mechanics of water flooding in such systems (intermediate wettability) has received but little attention and appears to be extremely complex. The microscopic displacement might no longer be dominated by capillary forces, or it might be dominated by capillary forces at low rates and by viscous forces at relatively high rates. This behavior would be manifested as a dependence of relative permeability upon rate and may possibly occur in the range of rates of interest. The criteria for scaling of experiments in systems of this type cannot be unambiguously stated at the present time. Much research will be required before the effect of rate on recovery from such systems can be fully described."

The present controversy between some laboratory technicians and practicing water-flood engineers can be resolved quite readily if we all will agree to broaden and emphasize the final sentence of that last quotation. The agreement of all parties for the need of much more study and research on all phases of water flooding should be the starting point toward the final reconcilation of our differences.

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Acknowledgments

Each of the coauthors of this paper prepared specific material as follows: Introduction, Buckwalter; Secondary Water-flood Oil Production in Texas, Edgerton; Water-flood Production in Oklahoma, Stiles; Some Economic Aspects of Water Flooding, Buckwalter; Methods of Analyzing Water-flood Field Data, Buckwalter; Effect of Curtailment on a Flood in Eastern Kansas, Earlougher; Pressure as a Factor in Water-flood Oil Recovery, Buckles; and Discussion of Laboratory Studies, Bridges.

All of these contributions were edited and unified by Buckwalter. The final manuscript was reviewed by O. H. Reaugh, of Ibex Co.; M. W. Keathley, Forrest Oil Corp. and E. A. Riley, of Ambassador Oil Corp. The authors are indebted to them for their helpful suggestions and to the sponsors of the paper, the Joint Industry Water-flood Committee, for making the preparation of the paper possible.

- Continuous flash-point recorder
- Simplified end-point apparatus

These two devices can help

Boost heater-oil production

BY S. F. KAPFF AND J. C. RHODES
Standard Oil Co. (Indiana)

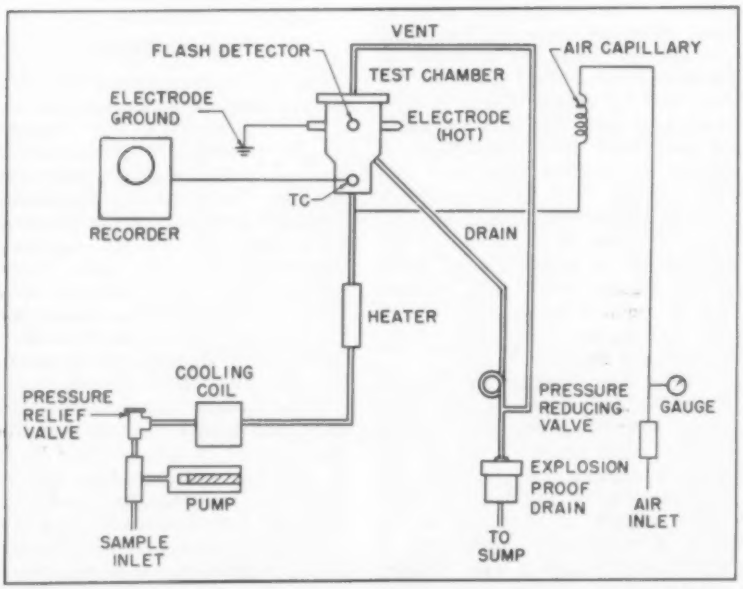
DURING CERTAIN SEASONS of the year there is an economic incentive to maximize the production of heater oil. One means of doing this is to increase heater-oil yields from fractionators by keeping the distillation range of the heater oil as broad as the specifications allow and by keeping the fractionations as sharp as possible.

Two important qualities of the heater oil, the flash point and the end point, essentially determine the yield that is obtained. The flash point is an indication of the characteristics of the lower end of the distillation curve and the end point of the upper end of the distillation curve. By keeping the flash point of the heater oil as low as the specifications allow, the upper part of the tower is operated under optimum conditions.

End point and flash point are normally determined by laboratory tests based on procedures described by ASTM. These tests are tedious, expensive, and require considerable time. In a large refinery, results may not be available until 2 to 4 hours after a sample is taken.

The difficulty of operating a fractionator efficiently under these conditions is well known. Because of this problem, the Engineering Research Department of the Standard Oil Co. (Indiana) has developed instruments to measure flash point and end point automatically. These instruments require no skilled operator, can be located on the unit site, and give quick, accurate results of the property they measure.

Paper presented at WPRA annual meeting, San Antonio, 1958, under the original title, "Instruments for Heater-Oil Production."



OIL AND AIR flow diagram for the semicontinuous flash-point recorder shows operation of device, which is fed continuously by a positive-displacement pump. Fig. 1.

Continuous flash point . . . A continuous instrument has been devised to measure flash point. The principle of operation is as follows (see Fig. 1): The sample is fed into the instrument continuously by a positive-displacement pump. The flow rate is about two-thirds of a gallon per hour.

The temperature of the incoming stream is first reduced to about 70° F. (or at least 20°-30° F. below the flash point of the oil) by refrigeration or heat exchange with cooling water. The sample then passes through a heater whereby the outlet temperature is raised gradually as time progresses.

Combustion air is continuously introduced into the liquid leaving the heater, and the air-vapor-liquid mixture passes into a test chamber where a constant level is maintained by overflow into a drain. The air-vapor mixture is exposed to a high-voltage spark once every 2 seconds.

When the liquid reaches a sufficiently high temperature, the air-vapor mixture becomes flammable. The spark ignites this mixture, causing a small explosion which is sensed by a flash detector located in the vapor space. The temperature of the liquid stream is measured by a thermocouple and recorded.

When an explosion is detected by means of an appropriate electrical circuit the recorder pen is driven downward, the heater and spark are turned off, and a 2-minute cooling period begins. After the cooling period, the heater and sparker are turned back on, the recorder pen is released and another cycle begins. Thus the temperature record is a saw-toothed curve and the peaks of this curve are the flash point of the sample. A reading is obtained about every 3 minutes. A typical record is shown in Fig. 2.

Range . . . The instrument has a flash-point range from 85° to 180° F. On samples which are free of H_2S or other highly volatile gases the results agree with those obtained with the Tag closed cup at about ±2° F. The readings obtained on samples containing excessive amounts of H_2S essentially agree with results obtained when the sample is first caustic-washed and then tested by the Tag closed-cup method.

Our experience has been sufficient to indicate that the average instrument requires less than 2 man-hours per week for corrective and preventive maintenance, and down time is less than 2%. Utilities required are: (1) electrical power (120 volts a.c.), 500 watts maximum, (2) water at a flow rate of ½ gal. per minute or other suitable means of cooling the incoming sample to a temperature of 70° F. (or at least 20°-30° F. below the flash point of the oil), and (3) air at 10-100 psig. (approximately 0.03 standard cu. ft. per minute). The instrument should be protected from weather and located where the ambient temperature is between 40°-100° F.

End-point instrument . . . The instrument for measuring the upper limit of the distillation range is called the end-point instrument. It is a batch-type instrument requiring only that the operator pour a sample into a cup and press a button to initiate the test. The device is shown schematically in Fig. 3.

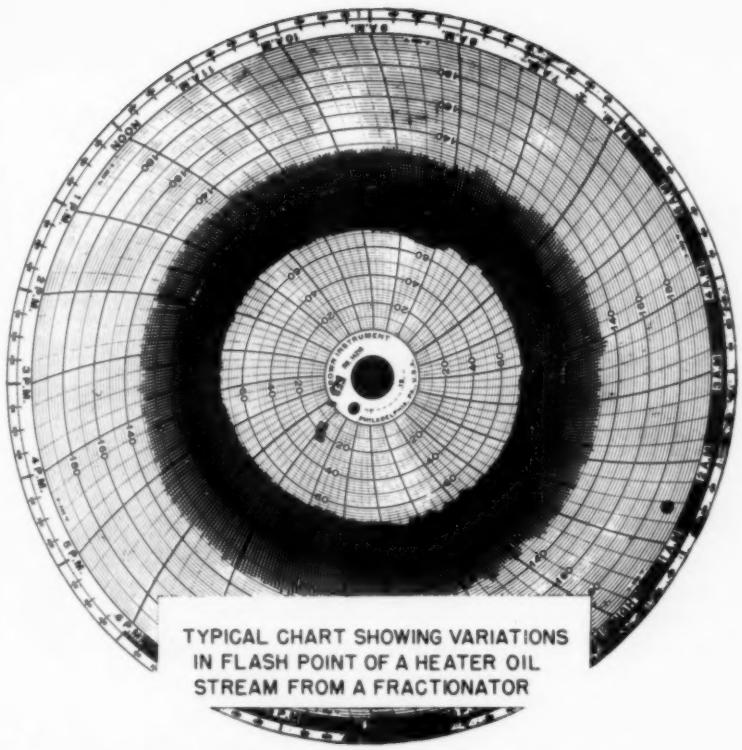
It consists of a sample cup, a flask in which the sample is distilled, a low-heat-capacity heater for evaporating the sample to dryness, and a thermocouple and recorder to measure the temperature of the vapors escaping from the flask. Solenoid-operated valves control the flow into and out of the flask and a program timer controls the steps of the testing cycle.

The sequence of events during a test is as follows: The operator pours the sample into the sample cup A (about 150 cc. or ⅓ pt.) and presses a button. The solenoid valves B and C open, allowing the sample to flush the flask. After the sample is exhausted from the filling cup, flow continues through valve C by siphon action until a fixed volume of liquid (28 cc.) remains in the flask. The considerable amount of flushing eliminates contamination by the previous sample. Next the heater is turned on and the two valves are closed.

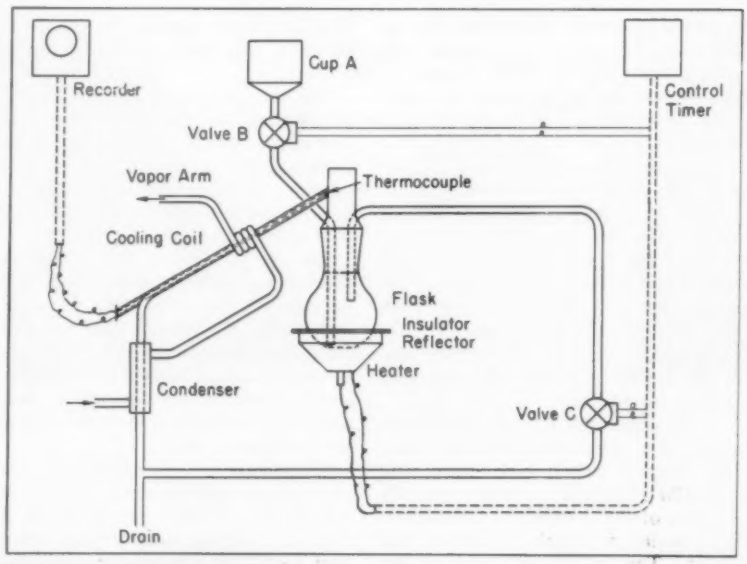
As the temperature of the liquid rises, vapor begins to escape through the vapor arm. The temperature of this escaping vapor is measured by a thermocouple which is located in the vapor arm. When the sample is evaporated to dryness the temperature in the vapor arm falls off rapidly. The highest temperature recorded is the end point of the sample.

A water-cooling coil around the vapor arm prevents temperature overshoot on samples with end points below 300° F. After the end point is reached, there is a short cooling period following which a green light comes on to indicate that another test can be started.

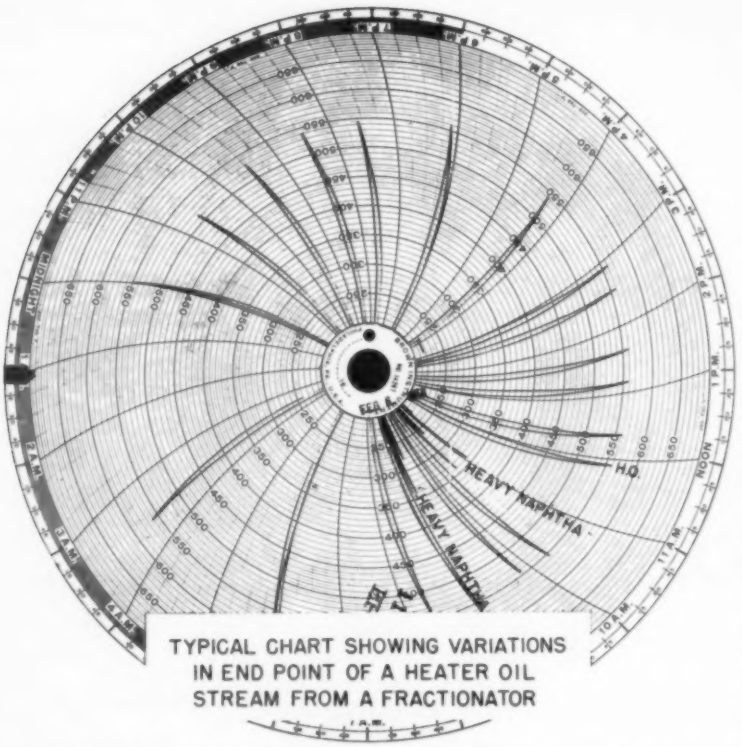
The instrument records end points within the range 200° to 700° F. and on heater oil the accuracy is at least as good as that of the standard test (±6° F.). The instrument is normally calibrated to agree with results ob-



TEMPERATURE RECORDS shows saw-toothed curve. Fig. 2.



END-POINT INSTRUMENT requires only that the operator pour sample into cup and press a button to start operation. Fig. 3.



TYPICAL CHART SHOWING VARIATIONS IN END POINT OF A HEATER OIL STREAM FROM A FRACTIONATOR

TIME REQUIRED for end-point test as indicated by chart is about 18 minutes. Fig. 4.

tained with ASTM D-158 but can be calibrated to agree with results obtained with ASTM D-86. Time required for testing is about 18 minutes. A typical daily chart record is shown in Fig. 4.

Since the instrument does not sample the stream automatically, it is usually located in or near the control room. The instrument should be protected from the weather and located where the ambient temperature is between 40° and 100° F. Utilities required are electrical power at 120 volts a.c. (300 watts maximum) and water at 50° to 100° F. (approximately ½ g.p.m.).

Field experience is sufficient to conclude that routine maintenance consists only of changing the flask after 300-400 runs and checking the calibration of the instrument periodically by running a sample of known end point. The instrument requires less than 1½ man-hours per week for corrective and preventive maintenance and down time is less than 1% of total time.

Improved Production

The increase in heater-oil production by the use of end-point and flash-point instruments is due to several factors. The yield of heater oil is increased by closer approach to specification limits. Under average conditions a 10° F. increase in end point increases the yield of heater oil by 6-8%.

The increase in heater-oil yield due to lowering the flash point is small. The direct benefits from lowering the flash point of heater oil are reduced stripping-steam costs and increased heavy-naphtha yields through improved fractionation.

Startup time has been reduced through use of these instruments. The operator is provided with information which allows him to make appropriate adjustments during startup and to divert streams to product storage as soon as satisfactory instrument indications are obtained, without waiting for laboratory results.

Supervisors are provided with records which allow them to check on the alertness of the unit operators. In the past, some periods of poor operation were excused on the basis that laboratory results were delayed. With these instruments, upsets and changes in operating conditions can be seen quickly and corrected without loss of production.

Off-specification product can be diverted to slop, avoiding contamination of good product. After operating conditions are corrected, the stream can be diverted back to storage with a minimum loss of production.

Furthermore, these instruments furnish information which allows the operator to discover the best means of recovering from upsets. Many an argument concerning the effect of changing a tray temperature or a flow rate has been settled by the "try and see" technique which is made practical by the rapid indications from these product-quality instruments.

Last is the economy of reducing the number of laboratory tests. Although it is considered good practice to continue sending some samples to the laboratory, the total laboratory-sample expense is substantially reduced. Routine samples serve to check on the performance of the instrument and indicate when servicing is needed. Likewise, the instruments often serve as a means of checking the performance of the laboratory.

Modifications . . . Although these instruments have been described particularly with respect to heater-oil production, they are being used for other applications. For example, a continuous flash tester, speeded up to give readings every 15 seconds, is being used to make cuts between gasoline and heater oil on a product pipeline. Another modified flash-point instrument is being used to monitor the flash point of heater oil during filling operations at bulk plants being operated without attendants on an experimental basis.[1]

The end-point instrument is being used on both finished and intermediate products. It has been found to give satisfactory results on products, with "normal" distillation curves, having end points in the range 200°-700° F. If the instrument is to be used on sharply fractionated stocks with "tails" (stocks with distillation curves that rise sharply after the 90% point), it must be modified or a correction must be applied. However, results obtained with the instrument on these sharply cut stocks are generally more reproducible than laboratory results.

Commercial availability . . . Both the end-point instrument and the continuous-flash-point instrument are licensed under Standard Oil Co. (Indiana) patent rights to a commercial-instrument manufacturer.[2] The commercial instruments are supplied with electronic recorders. The instruments are explosionproof, except for the recorders which can be made suitable for Class I, Group D, Division II areas, or located remotely in safe areas.

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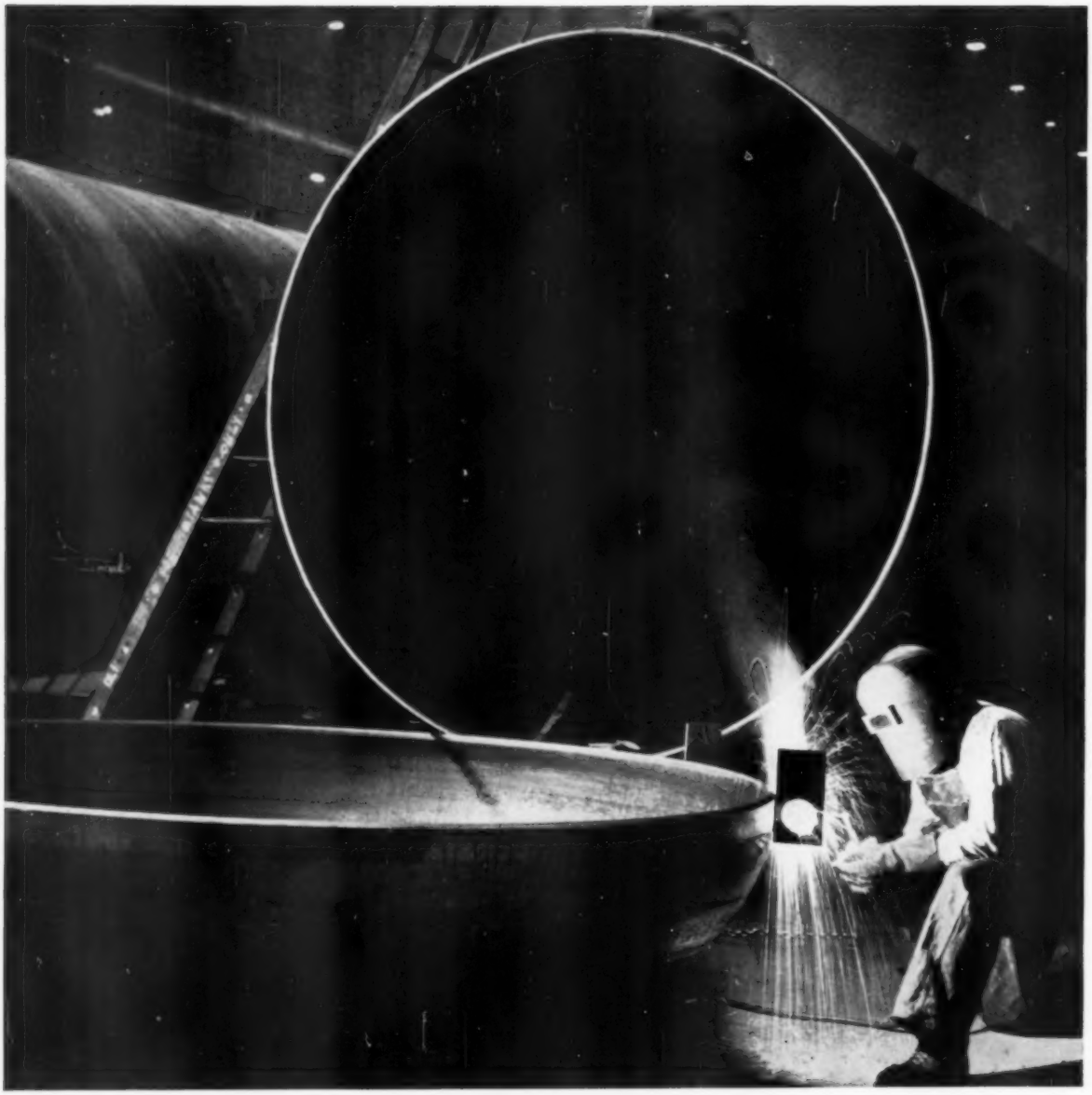

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This reduced form of the Benedict-Webb-Rubin equation can give a practical solution of . . .

PVT behavior for similar gases

BY S. R. DARIN, E. B. STUART, AND JAMES COULL

THE BENEDICT - WEBB - RUBIN equation of state precisely represents the PVT data for a single gas.[1] The precision of this equation is not utilized in many engineering applications because of the inconvenience of the eight-constant, pressure-explicit form.

A method is presented for obtaining a reduced form of the equation that may be used for a group of similar gases. A compressibility chart using the reduced equation is presented for convenience. A volume - explicit form is also presented for a narrow range of pressures and temperatures.

The original equation is:

$$P = RTd + (B_oRT - A_o - C_o/T^2)\,d^2 + (bRT - a)\,d^3 + a\alpha\,d^6 + \frac{cd^3\,(1 + \gamma\,d^2)\exp.\,-\gamma\,d^2}{T^2} \quad (1)$$

By using the following definitions interms of the critical properties:

$$P = P_rP_c;\quad T = T_rT_c;\quad V_c' = RT_c/P_c;\quad V = V_c'V_r'$$

the original equation was transformed to the following reduced form:

$$P_r = T_r/V_r' + (K_1T_r - K_2 - K_3/T_r^2)\,(V_r')^{-2} + (K_4T_r - K_5)\,(V_r')^{-3} + K_6\,(V_r')^{-6} + \frac{K_7\,(V_r')^{-3}\,[1 + K_8\,(V_r')^{-2}]\exp.\,-K_8\,(V_r')^{-2}}{T_r^2} \quad (2)$$

The eight constants in Equation 2 are the arithmetic averages of the individual values for methane, propane, n-butane, i-butane and ethylene. The definition of the constants and the numerical value used in constructing the compressibility chart are given in Table 1.

TABLE 1

Constant in Equation 2	Definition	Average value*
K_1	$\frac{B_oP_c}{RT_c}$	0.130600
K_2	$\frac{A_oP_c}{R^2T_c^4}$	0.322304
K_3	$\frac{C_oP_c}{R^2T_c^4}$	0.153434
K_4	$\frac{bP_c^2}{R^2T_c^2}$	0.041620
K_5	$\frac{aP_c^2}{R^3T_c^3}$	0.53419
K_6	$\frac{a\alpha P_c^5}{R^6T_c^6}$	0.000102201
K_7	$\frac{cP_c^2}{R^3T_c^5}$	0.0535831
K_8	$\frac{\gamma P_c^2}{R^2T_c^2}$	0.0433462

*Numerical values are arithmetic averages using CH_4, C_2H_4, C_2H_6, C_3H_8, n-C_4H_{10}, i-C_4H_{10}.

In constructing the compressibility chart, values of P_r corresponding to assumed values of V_r' and T_r were calculated. Compressibility factors, Z, were determined from the relationship:

$$Z = P_rV_r'/T_r = PV/RT$$

Calculated compressibility factors were plotted versus P_r with parameters of T_r. The P_r values range from $P_r = 0$ to $P_r = 10$, and T_r varies from $T_r = 1.0$ to $T_r = 5.0$.

The chart was compared to a generalized compressibility chart prepared by E. F. Obert[2] and to experimental data. The greatest deviations occurred at isotherms $T_r = 1.05$ and $T_r = 1.10$. Above $T_r = 1.10$ the two charts agreed well with deviations of 2.2% or less. The average deviation was —0.338%.

The chart was compared with actual data for methane,[3] ethane,[4] propane[5], and ethylene.[6] Over the range of the graph, ethane and propane resulted in average deviations of 1.48% and 0.483% respectively. Ethylene was checked at three isotherms ($T_r = 1.11$; $T_r = 1.245$; $T_r = 1.32$), and gave an average deviation of —3.07% with the deviations decreasing at the higher isotherm. Five isotherms from $T_r = 1.06$ to $T_r = 2.48$ for methane resulted in an average deviation of —0.1%. The large negative deviation for $T_r = 1.06$ tends to mislead since the average deviation of the four isotherms excluding $T_r = 1.06$ is +2.14%.

These comparisons for the four gases indicated the limits of accuracy of the graph to be within approximately 5% for reduced temperatures above $T_r = 1.10$ and for reduced pressures from $P_r = 0$ to $P_r = 1.75$

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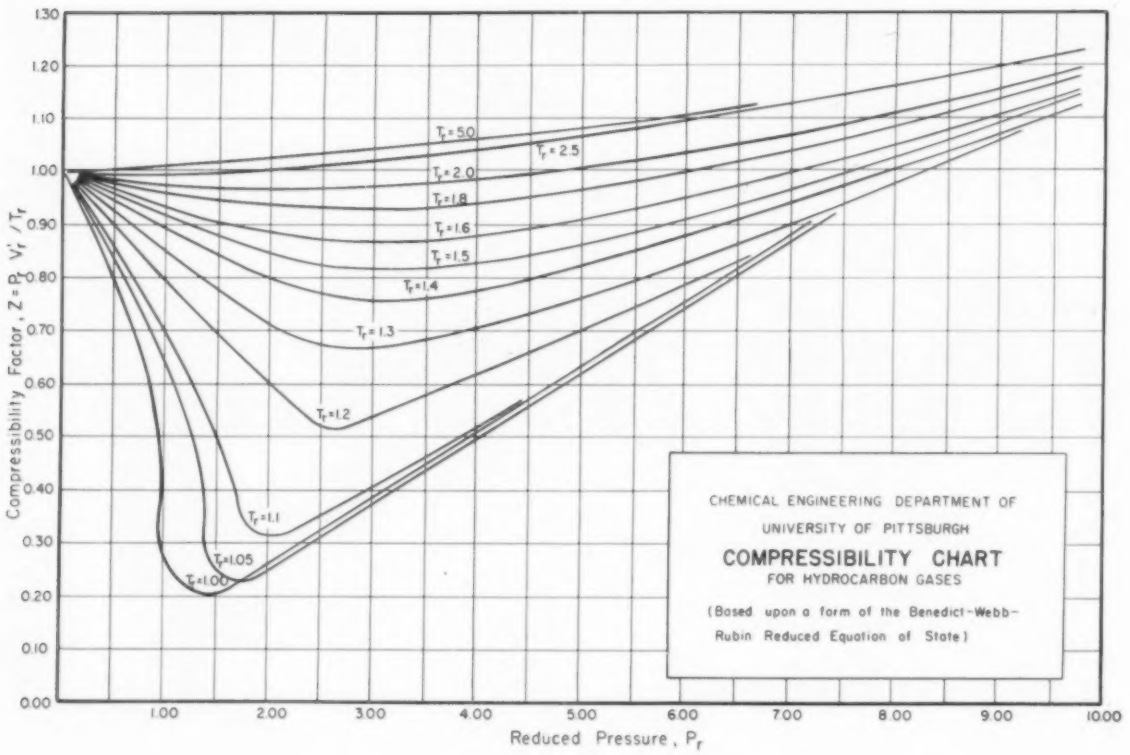

and from $P_r = 4.0$ to $P_r = 10.0$.

An approximation to the volume explicit form can be obtained by multiplying Equation 1 by V/P:

$$V = RT/P + (B_oRT - A_o - C_o/T^2)\,(1/PV) + (bRT - a)\,(1/PV^2)$$
$$+ a\alpha/PV^5 + (c/PV^2T^2)\,(1 + \gamma/V^2)\exp. - \gamma/V^2 \qquad (3)$$

The equation can be made explicit in volume by substituting the approximation, $V = RT/P$. This gives the following form:

$$V = RT/P + (B_oRT - A_o - C_o/T^2)\,(1/RT) + (bRT - a)\,(1/P)\,(P/RT)^2$$
$$+ (a\alpha/P)\,(P/RT)^5 + (c/PT^2)\,(P/RT)^2\,[1 + \gamma\,(P/RT)^2]\exp. - \gamma\,(P/RT)^2 \qquad (4)$$

The volume explicit equation was checked with the experimental data for methane,[7] ethane,[4 8] propane,[5] n-butane[9] and benzene.[10] The range of applicability is given in Table 2.

TABLE 2

Gas—	Pressure (atm.)	Temperature (°C.)
Methane	0-200	0-200
Ethane	0-345	125-275
Propane	0-300	225-275
n-Butane	0-300	250-300
Benzene	(Not applicable)	

Nomenclature

d = density = $1/V$
P = pressure, atm.
P_c = critical pressure
P_r = reduced pressure = P/P_c
R = gas constant = 0.08207 liter-atm./g. mole, °K.
T = temperature, °K.
T_c = critical temperature
T_r = reduced temperature = T/T_c
V = volume, liters/g. mole
V_c' = critical volume, pseudo = RT_c/P_c
V_r' = reduced volume = V/V_c'
Z = compressibility factor = PV/RT
A_o, B_o, C_o, a, b, c, α, γ are constants in the Benedict-Webb-Rubin equation
K_1, K_2, K_3, K_4, K_5, K_6, K_7, K_8 are arbitrary grouping of the constants as defined in Table 1.

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"Twenty-seven straight dry holes is playing Old Ned with our trade name."

REFINERY IN COLOMBIA

On shores rich in the romance of the Spanish Main, a new refinery is in operation, adding production that makes Colombia virtually self-sufficient in petroleum products.

The 28,500-barrel Cartagena Refinery stands on an historic site near one of the first cities of the New World, founded in 1533. It is owned by International Petroleum (Colombia) Limited and manufactures gasoline, jet fuel, diesel and fuel oils, kerosene, naphtha and LPG.

This integrated plant was built from the ground up in 18 months.

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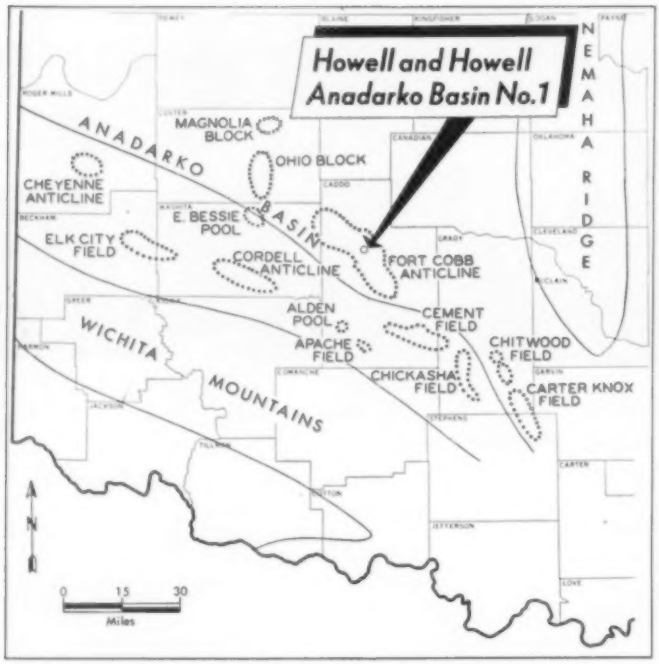


The Howell & Howell Anadarko Basin No. 1 is set up to test the Arbuckle limestone on the Fort Cobb anticline. The top of the Arbuckle is estimated between 22,500 and 24,000 ft. Here's some of the thinking that goes into. . .

Planning a 24,000-ft. test

BY NORMAN S. MORRISEY
Drilling-Development Editor

TESTING the Fort Cobb anticline in Caddo County, Oklahoma will require a 20,000-ft. hole to reach the Bromide sand. And to evaluate the Arbuckle limestone, the well will have to be 21,000 to 24,000 ft. deep. Howell & Howell, Dallas, are currently drilling below 16,200 ft. in an effort to determine if this large seismic structure in western Oklahoma will produce.

Operators state that this initial test, the 1 Anadarko Basin (4-9n-12w) will cost $2,250,000 to drill and complete. Subsequent tests, however, should be less expensive if the first is successful, probably on the order of $1,750,000. If the operators' plans materialize the 1 Anadarko Basin will be the deepest well in the world.

Planning the test . . . Howell & Howell, Kenneth Ellison, and Gulf Oil Corp., the working-interest partners, spent several years in working out the details and in planning this deep test. Howell & Howell purchased a rig that can drill to 25,000 ft. It is specially designed for the job. And it is powered by three 825-hp. engines. When the contractor ran 7,898 ft. of 13⅜-in. casing, the rig had ample power to spare when called upon to lift a hook load of 570,000 lb.

When the time comes to run the 9⅝-in. casing, there will be an estimated 1.5 million pounds on the substructure. This includes the drill pipe that will be stacked in the derrick rather than laid down, plus 11,500 ft. of 9⅝-in. casing. To handle this load, the contractor constructed a cement foundation for the substructure to eliminate the chance of the rig shifting from vertical and to give a good solid foundation for the substructure. The cost of the foundation alone was $19,000.

Howell & Howell's rig has many unusual features. The rotary table is 20 ft. above the ground. An automatic driller is used.

Drilling to 24,000 ft. is an expensive proposition. The estimated bit bill will exceed $200,000. When the contractor ran 13⅜-in. casing at 7,903 ft., the bit bill totaled $43,600. This included 52 bits; the surface bit was 24-in. and the other 51 bits were 17½-in. Each of the latter cost $823. The surface bit cost $1,650.

The drill pipe and tool joints will run $375,000. Slightly less than half of this, or $180,000, is for the drill pipe, and the balance, or $195,000, is for the tool joints. Cost of the record string of 13⅜-in. casing added up to $90,000, or $11.12 per foot.

Drilling crew . . . Howell & Howell are doing their utmost to prevent accidents. Two tool pushers spell each

What it takes to drill a 24,000-footer

A-1500 Continental-Emsco drilling rig
3 Waukesha VLRDBGU
2 GR-GXR Gardner-Denver mud pumps
Lee C. Moore 142-ft. mast
PJ—27½—Continental-Emsco rotary table
L-400 Continental-Emsco swivel
MA-50-6 Continental-Emsco traveling block
Continental-Emsco GB catheads
Elmagco electric brake
5500 Byron Jackson hook
10,200 ft. of 1⅜-in. 6 x 19 Broderick & Bascom power-steel wire rope

BLOWOUT PREVENTER

1—12-in. series 1500 Hydril "GK" Blowout preventer
2—14-in. Series 1500 Cameron Type SS blowout preventers
Model A-NS-100 Payne Automatic Accumlator unit with 1—No. 9 Fluid Control Manifold and 1—No. 6 Remote Control Unit each with 6—4-way valves.

other on 12-hour tours. The oldest and most experienced driller is on the morning tour since experience has shown that this is the time when accidents are most likely to happen. Each crew is composed of six men—the driller, the derrick man, and four roughnecks.

All of the crew are experienced in deep-hole drilling. And as a safety factor, Howell & Howell make certain that one man on the floor, in addition to the driller, can handle the driller's duties.

Deep drilling problems . . . No area is without its drilling problems and as you go deeper, these compound rapidly. Howell & Howell have designed a drilling and casing program that they hope will minimize these problems.

One of the biggest problems in deep-hole drilling is running out of hole. In short, when you get below 20,000 ft. you discover you may be drilling below 5½-in. casing with too small a bit and not enough room to work in should trouble develop. Table 2 shows the drilling program and the hole size for this deep test. Below 19,000 ft. Howell & Howell plan to drill with an 8⅝-in. bit below 9⅝-in. casing set at 19,000 ft. Should trouble develop they can then run a 7-in. string if they desire.

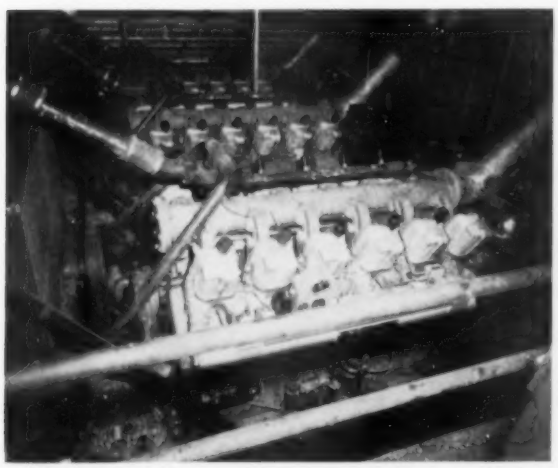
The drill string, too, required considerable planning and engineering. Table 3 shows how they plan to set up their drill string to handle the deep drilling.

Geology . . . The 1 Anadarko Basin is well located structurally on one of the largest seismic features in western Oklahoma, the Fort Cobb anticline. This structure trends northwest-southeast and is 20 miles long and 6 miles wide. It has a vertical closure of more than 350 ft. on Upper Pennsylvanian markers. Recent seismic work has confirmed that the structure persists with depth.

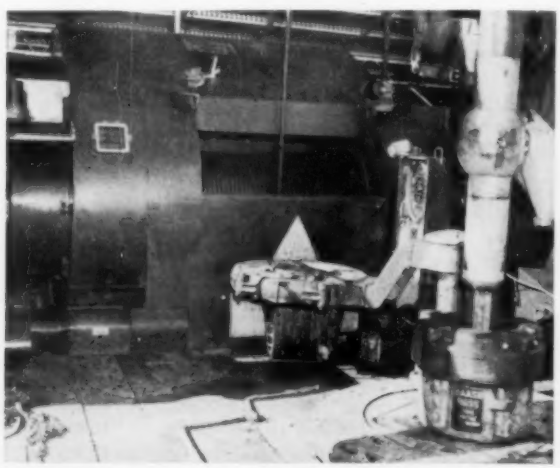
The Fort Cobb anticline has had several tests drilled on it and most of these have logged good shows of oil or gas in the Pennsylvanian. None of these wells, however, has reached the Ordovician beds, now the principal target for deep drilling in the area. Deepest test on the structure to date has been the Superior 1 Weller which bottomed in Springer beds at a total depth of 17,823 ft. The Weller had shows of gas in the Springer section as well as in several shallower zones.

A significant factor has been the recent successful deep drilling campaign at Carter-Knox, 55 miles southeast of the Fort Cobb structure. At Carter-Knox British-American Oil Producing Co. and others are developing deep and prolific Simpson production at about 15,000 ft. The discovery well, British-American 2 Harrison, had 220 ft. of saturated Bromide sand and was completed for 175 M.c.f. of gas and 24,100 bbl. of condensate per day. This well paid for itself in less than 1 year. The favorable economics of this deep gas-condensate production played a major role in persuading the operators to drill at Fort Cobb.

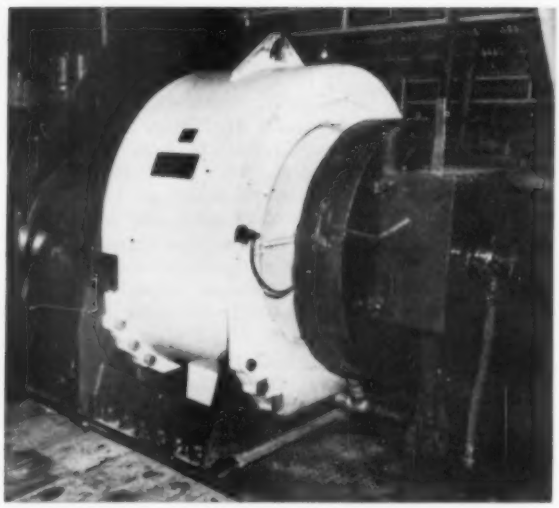
Another factor was the successful completion of the world's deepest test,



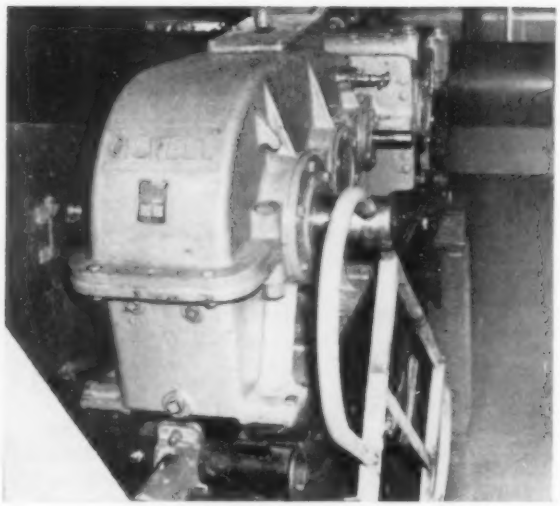
POWER for the drilling rig is supplied by three 825-hp. butane engines giving a total output of 2,475 hp.



CONTRACTOR is using 1⅜-in. wire rope. In center of photo are power slits used going in and out of hole.



ELECTRIC BRAKE is a feature of the rig, which is capable of drilling below 25,000 ft. White housing covers brake.



AUTOMATIC ACCUMULATOR UNIT with fluid control manifold, operating through draw-works drum, regulates feed rate of drill pipe.

TABLE 1—CASING DESIGNS

Interval, ft.	Length interval, ft.	Casing size, o.d. in.	Weight and grade, lb. per ft.	Type joint	Wt. of interval, lb.	Cum. wt., lb.	Joint strength 1,000 lb.	Safety factor tension	Collapse resistance, lb./sq. in.	Collapse pressure, psi.	Safety factor collapse (pipe empty)
0-500	500	20	72.16 J-55	Plain end							
0-8,000	8,000	13⅜	85 lb. N-80	ST&C	680,000	680,000	1,029	1.51	4,320	4,000	1.08
7,500-19,000	11,500	9⅝	43.5 lb. P-110	Hydril FJ	500,000	500,000	841,000	1.68	4,760	4,225 at 9,100 ft.	1.125 to 9,100 ft.

Richardson & Bass 1-L Humble-LL&E-State. This well reached a total depth of 22,570 ft. and it is producing from Miocene sands below 20,000 ft.

Other recent tests have also served to convince the operators that a 22,000-test in western Oklahoma can become a reality. Recently, for example, Pan American Petroleum Corp. completed its 1 C. S. University in Pecos County, Texas, at a total depth of 21,687 ft. and Phillips Petroleum Co. has recently set a world's depth record in West Texas.

The surface string consisted of 500 ft. of plain-end 20-in. o.d. 72.16-lb. (0.344-in. wall) Grade B electric-weld pipe. This pipe was beveled on the ends and was welded together. A 17½-in. hole was drilled below the shoe of the 20-in. casing to 7,903 ft.

TABLE 2—DRILLING PROGRAM

Interval drilled, ft.	Hole size, in.	Size casing set, in.	Smallest i.d. of casing, in.	Largest o.d. of casing in open hole	Max. mud weight, lb.
0-500	24	20	19.312	20.00	9.625
500-8,000	17½	13⅜ o.d.	12.059	14.375	9.625
8,000-19,000	12	9⅝ o.d.	8.755	9.625	14.0
19,000-25,000	8⅝	7 o.d.	.....	7.00	14.0

Design problems . . . Howell & Howell wanted to set the 13⅜-in. casing (see Table 1) to approximately 8,000 ft. and wanted this string to have a high enough collapse pressure so the fluid level inside the 13⅜-in. could drop to 7,500 ft. without hazard of the casing collapsing. It would also be

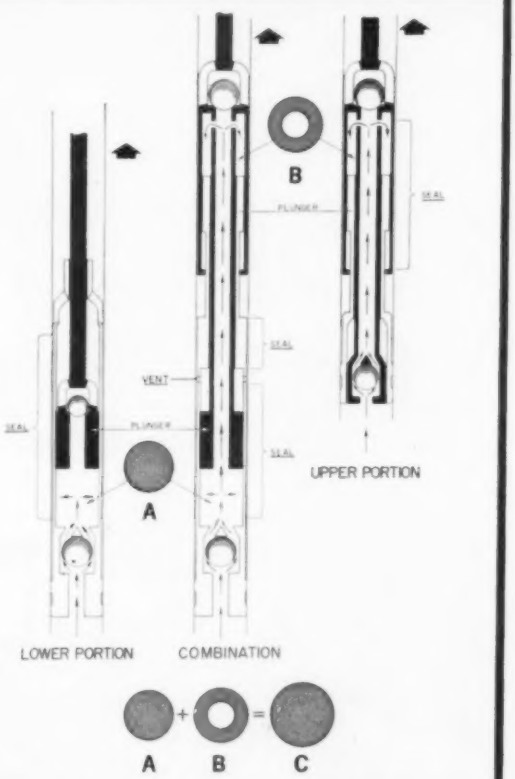
TABLE 3—EXAMPLE CALCULATIONS OF COMBINATION DRILL PIPE DESIGN

(Depth 25,000 ft.; mud weight, 14 lb./gal.; thirty 6½-in. o.d. by 3¼-in. i.d. drill collars)

Interval, ft.	Interval length, ft.	Size of drill pipe, in.	Wt. per ft. and grade	Weight of interval, lb.	Weight of interval less buoyancy of mud, lb.	Cum. wt., lb.	Tensile strength, pipe body, lb.	SF tension
24,100-25,000	900	*6½	85 lb.	76,500	62,800	62,800	.....	.....
8,100-24,100	16,000	4½ o.d.	16.6 x 95	266,000	218,000	280,800	418,730	1.49
4,000-8,100	4,100	5 o.d.	19.5 x 95	80,000	65,600	346,400	501,080	1.45
0-400	4,000	5½ o.d.	24.7 x 95	99,000	81,400	427,800	629,850	1.47

*Drill collar.

NEW AXELSON VOLUMAX INCREASES PRODUCTION FLOW



Shaded circles indicate volume areas. Plunger area (A) plus annular area (B) result in increased production area (C).

Axelson's new Volumax pumps will outperform any similar pump currently available for 2″ tubing.

Special ⅞″ liner column uses ⅞″ plunger to effectively seal and create an upper telescoping annulus. Resulting production is 22% more than that obtained with a tubing pump.

Lower portion plunger area (A), plus upper portion annulus area (B), combine to provide increased volume (C).

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necessary that the threaded joint on the 13⅜-in. casing develop sufficient strength to safely carry the load of this very long and heavy string.

The 13⅜-in. o.d. 72-lb. N-80 casing has a D/t ratio of 26.02. This casing will collapse due to external pressure in the elastic range; that is, the failure occurs due to extreme deformation before the stress reaches the yield strength. For 72-lb. N-80 the collapse pressure is only 2,880 psi. and the setting depth is only 5,120 ft. (set in 9.625-lb./gal. mud with a safety factor of 1⅛ in.) which was far short of Howell & Howell's requirements. Increasing the steel grade to P-110 would not improve the collapse resistance of the 13⅜-in. o.d. 72-lb. casing because of the nature of elastic failure. Calculations indicated that the best solution to the collapse and tension requirements would be a 13⅜-in. o.d. N-80 casing with a D/t ratio at 22 finished with API eight-round threads and coupling.

Arrangements were made for a special string of casing with the following dimensions and performance properties:

13⅜-IN. O.D. 85-LB. N-80 CASING WITH API THREADS

Wall thickness, in.	0.608
Internal diameter, in.	12.159
Drift diameter, in.	12.003
Cross-sectional area of metal, sq. in.	24.39
D/t ratio	22
Internal pressure at minimum yield, psi.	6,360
Mill test pressure, psi.	5,820
Joint strength, lb.	1,029,210
Collapse pressure, psi.	4,320
Setting depth in collapse (S.F. = 1⅛), ft.	7,680

Record job . . . On January 28, 1958, Howell & Howell ran, landed, and cemented 7,898 ft. of this special 13⅜-in. o.d. casing. This is believed to be one of the longest and probably the heaviest string of 13⅜-in. casing ever run.

The casing was handled with slip-type elevators and was made up with power casing tongs. Torque ranged from 6,500 to 15,500 ft.-lb., with an average torque of about 8,500 ft.-lb. Thirteen and one-half hours were required to run the casing.

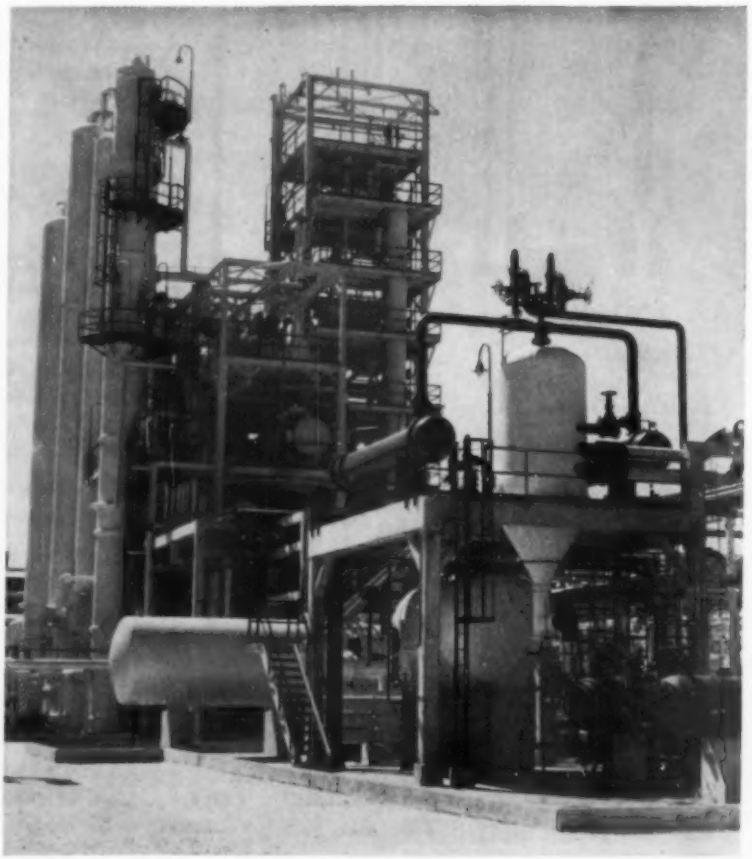
The calculated weight of the 13⅜-in. o.d. casing in air was 665,000 lb., and the calculated weight in 9.625-lb./gal. mud was 568,000 lb. corresponding to a weight indicator reading of 570,000 lb. when all the casing was on the hook and filled with mud.

The tension safety factor at the joint, based on the weight of air, was 1.55, and based on the weight in mud was 1.81, which was considered adequate. Float equipment would further increase these values.

A differential fill-up float shoe and collar were used, which automatically filled the casing through the shoe to approximately 81% of its volume. The pair of differential fill-up floats would contribute an additional 86,500 lb. buoyant force, increasing the joint strength safety factor to 2.15 during running.

It was intended to cement through the shoe with cement returned to the surface. Fifty-three hundred sacks of cement were displaced through the shoe without getting returns to the surface. A 13-lb./gal. slurry weight was used. A temperature survey established the top of the cement was at 6,073 ft. A 750-ft. string of 1-in. pipe was run in the annulus between the 13⅜-in. casing and the 20-in. surface casing and an additional 1,000 sacks of portland cement were displaced, getting good returns to the surface.

Drilling is now in progress making a 12-in. hole below the shoe of the 13⅜-in. casing.

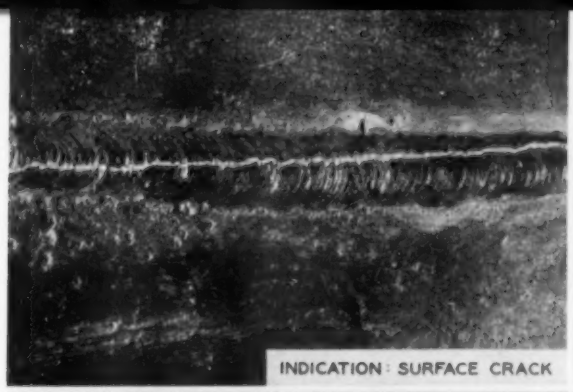


Ethyl's new plant goes on stream

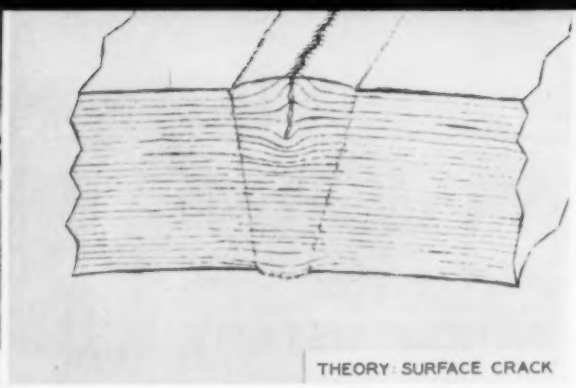
ETHYL CORP.'S newly opened plant at Baton Rouge is first in Louisiana to produce vinyl chloride monomer in commercial quantities.

Hydrogen chloride byproduct of the plant will be used in other intermediate chemical manufacturing operations there. The plant is a part of Ethyl's Baton Rouge manufacturing center, site of the world's largest gasoline antiknock compound plant.

Catalytic Construction Co. of Philadelphia was contractor for the facility. Dr. Clarence Neher and H. E. O'Connell of Ethyl were project managers.

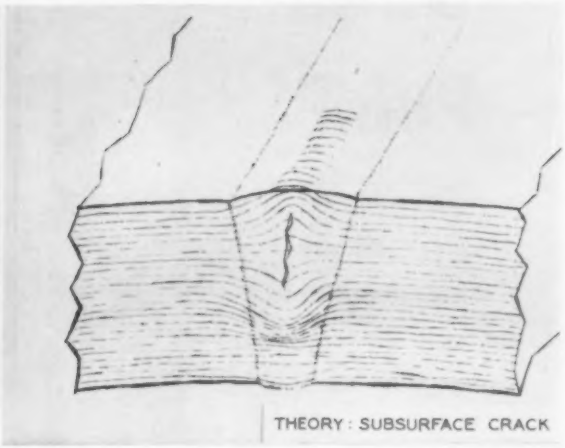


INDICATION: SURFACE CRACK



THEORY: SURFACE CRACK

INDICATION: SUBSURFACE DEFECT



THEORY: SUBSURFACE CRACK

Weld defects such as these are avoided or detected by . . .

Modern pipeline field welding and quality control

Improved equipment, methods, and tests, controlled by rigid standards, have changed pipeline welding from an art to a science which has made pipelines more durable and dependable

BY A. G. BARKOW
Superintendent of Inspection
Natural Gas Pipeline Co. of America

IN MODERN pipeline welding, acetylene still finds its use in small-diameter, thin-wall pipe used around pumping or compressor stations, meter settings, and similar work.

Its most important role is played in the cutting torch and here it still is an indispensable tool. With steels of higher chemistry and with all-weather work, acetylene also is finding a new field in preheating. With a slightly oxidizing flame it does not leave a carbon deposit on the beveled face, thus leaving a clean surface to work with. Acetylene also has been used as the heating unit for a flash butt weld in experimental work, but this process has not been developed to practical application as yet.

Paper presented before the ASCE Pipeline Division, Chicago.

Manual electric-arc welding using the common shielded electrodes of the all-positions E6010 and E7010 classification is the general practice in field welding today. However, the art of field welding is not "common."

Field Welding

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With all these contradictions to ordinary welding technique, the finished weld is still equal and in many cases superior to shop welding. Besides these radical changes in technique, field welding has developed a unique production method that permits greater mobility of the welding crew.

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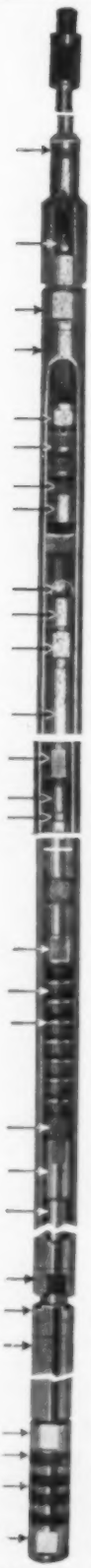

Figs. 600-800-900

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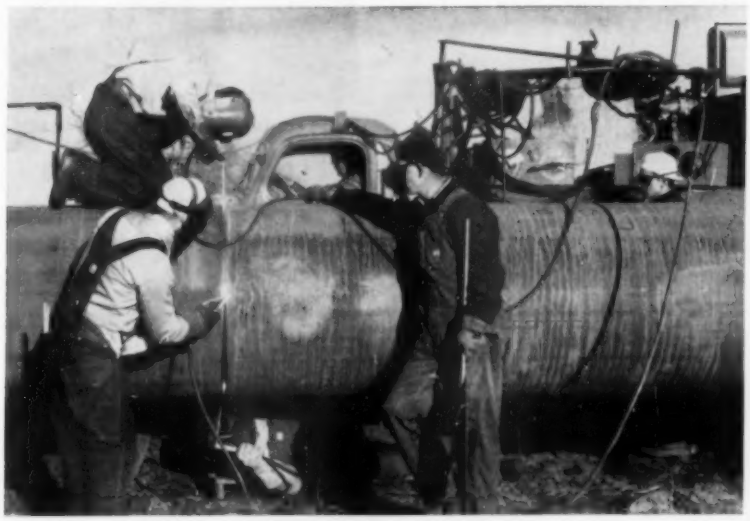
Lineup clamp eliminates tack welds, mismatch



Speedy four-man team applies stringer bead

Field welding is really divided into three operations, each complementing the others. The first group of welders, the stringer-bead hands, consists of either two, three, or four welders who do nothing but lay in the first bead. It is interesting to see four hands on a stringer bead of 30 or 36-in. pipe working simultaneously. Usually two welders are right-handed and two are left-handed. The work is done with machine-like precision.

Stringer bead . . . While we talk of the stringer-bead welders we also must mention another group of craftsmen, the lineup crew. These men line up the joint to a precise gap between the two pipes and clamp the pipe tight with an internal lineup clamp. The gap may range from dime width to nickel width, depending on the welder's choice. Dime width is used most frequently.

No tack welds are used, but step welding is common practice. Here the welders use one-rod-length beads, working in opposite quarters and step upward or downward depending on the side being welded.

To clarify this method, I might discuss the procedure of a two-man crew. One welder will start welding at about 1 o'clock on the periphery and weld to 3. In the meantime, the other welder is welding from 8 o'clock to 6. The first will then weld from 4 o'clock to 6 making sure of a good bottom lap, while the second welds from 12 o'clock to 10. Finally both welders will finish the sides.

Such a procedure is used to minimize shrinkage and prevent closing of the welding gap. This whole procedure from lining up a joint to completion of the stringer bead takes far less time than it has taken to tell about it.

A good stringer-bead welder will make a weld with a smooth, even internal bead about $\frac{1}{8}$ in. high and about $\frac{3}{4}$ in. wide. The bead will be so smooth that few who have not seen this work before will believe that the bead was put in from the opposite side. Stringer-bear welders are top hands and are recognized as such by the welding fraternity.

Hot pass . . . A second group of expert welders now move in—"the hot-pass welders." They, too, work in groups of two or four, usually two to a weld, leapfrogging each other. This crew puts in the second pass and thus completes the weld to a self-sustaining strength. The hot-pass crew works so close to the stringer-bead crew that the weld does not have an opportunity to cool.

This second pass not only strengthens the weld with added metal but also repairs any gaps or "windows" left by the stringer-bead men. The heat of the second application also produces a stress-relieving heat treatment in the first pass which prevents cracking or other damage. This crew also leaves the uncompleted weld after its special task and moves forward.

The third crew of finish welders follow farther behind and actually finish the weld. Typical field-welding procedure calls for one bead for each $\frac{1}{8}$-in. of metal thickness, plus the root and cover pass.

Thus a typical $\frac{3}{8}$-in.-wall pipe would require five passes. Frequently an extra stripper pass is used on both sides to help fill the groove. This stripper pass usually runs from 2 o'clock to 4 and from 10 o'clock to 8, and is placed in before the final cover pass.

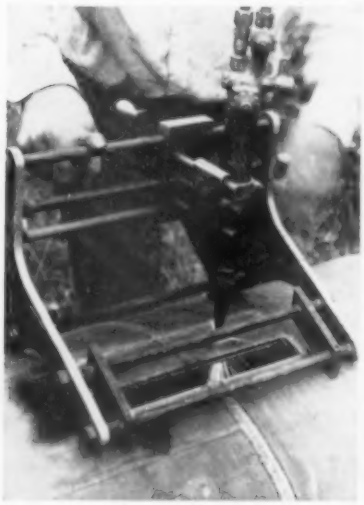
Importance of Cleaning

Cleaning is not just another chore that can be done just as a matter of procedure. A great deal of weld quality depends on the cleaning and preparation between passes. Many inferior welds could be saved by proper preparation. A little chipping of holes or high spots, a few extra jabs of ice picks in under cuts, a little grinding, and a little more care save hundreds of dollars for the contractor in the salvage of potentially inferior welds. Speed is a commendable asset in pipeline welding, but haste in cleaning makes waste.

Commonly used welding generators are either gasoline or diesel driven, portable d.c. welders of 300-amp. rating. Arc current and stability require smooth, constant, and instantaneous action.

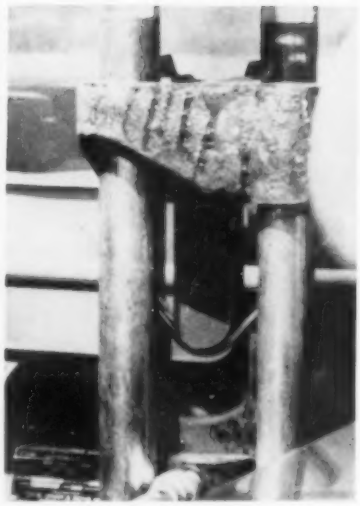
Thus weld quality actually starts at the generator. This then is the starting point of weld inspection, and the welding inspector frequently checks the generators. He has the power to take

Welders must pass rigid qualification tests



Speciment is cut . . .

It's tension tested . . .



It's bend tested

Then nondestructive testing spot checks performance, by . . .

X-rays, using radiographic pig . . .

. . . and sometimes magnetic inspection

a machine off the line as readily as a welder.

Pipeline welding is probably the only method that condones the practice of mixing electrodes for carbon-steel welds. In pipeline welding the E 6010-type rod is used for the stringer bead because of its greater ductility under movement of the pipe. The E 7010 type electrode is used for the remaining passes to secure desired strength. The cover pass may be made with an E 6010 electrode because of appearance.

This practice was started by pipeline welders through field tests and research so that the most advantageous physical properties could be produced in each layer of weld metal. These properties include ductility at the root, strength in the body, and smoothness in the cover.

Field-welding features . . . In contrast to power-piping welding and shop fabrications of piping, the two outstanding features of field welding are the downhill method and the comparatively narrow weld.

Downhill welding—that is, starting at the top of a stationary weld and working to the bottom of the pipe—allows for greater arc speed in a narrower groove. A very short arc is maintained and the root pass is made by burning through the adjoining lips in such a manner that the puddle fills the gap to produce a full, smooth inside bead. A high degree of skill is required to hold the speed at just the right rate to maintain the opening and the puddle relationship so that no break resulting in a "window" or a lack of full penetration results.

The welder must respond instantly to any fluctuation in arc voltage and most stringer-bead welders can do that almost with the accuracy of an electronic control. Stringer-bead welding rate is between 20 and 30 in. per minute.

The second pass, commonly referred to as the hot pass, is similarly welded at a high rate of speed. The art in this pass is to wash out any defects left in the root pass and to produce a solid foundation for the completion of the weld.

Automatic Welding

Some may wonder why some type of automatic welding has not been adopted to pipeline welding. The answer is simply that there does not yet exist for crosscountry welding any other process with the necessary speed and flexibility.

Numerous attempts have been made to adapt automatic welding to pipelines with some little success.

Some years ago a pressure-butt-welding method was developed in which the ends of the pipe were heated with gas flames to an advanced plastic state. The pipe was then "bumped" togethed to achieve fusion.

The unsolved problem with this method was the holding of the pipe in proper alignment during the "bumping" process.

Submerged arc welding, successfully used for the longitudinal seam, is being adopted to "rail head welding"—a method of welding two joints of pipe at a central location before stringing. This method has a fairly successful history and does speed progress in the field since the same number of field welds will give twice the footage.

Difficulty, however, has been encounted in producing a sound stringer bead without a backup ring. Manual first passes are commonly used, making this method partially dependent on manual welding.

The most recent development in this field is a submerged arc process in which the outside beads are welded first with use of a relatively heavy bead. The inside bead then is made by the same process, using an automatic head held by a boom on which the operator also rides.

This is the first fully automatic machine-made weld. But this process is still only applicable to double jointing. A great deal of experimental work is being done in this field, particularly in view of the shortage of real experienced stringer-bead welders.

A process that may hold the answer is the shielded inert-gas metal-arc process which at present is finding widespread application in other fields of welding. No real field trials have been made with this process although it has been successfully used for prefabricated pipe welding.

Welding electrodes other than those mentioned above also are being investigated for possible application. Among the latest developments in this field are the low-hydrogen and iron-powder contact electrodes. The need for a control of notch sensitivity and under-bead cracking makes the use of low-hydrogen electrodes very desirable.

The low-hydrogen iron powder contact electrodes also find some application where downhand welding can be used. This is particularly true in the welding of sleeves, saddles, pads, and other pipeline attachments. It therefore is evident that pipeline welding is a living, dynamic science and that great strides toward improved welding are emminent.

Internal Lineup

Pipeline equipment largely is a development of the practical field man and frequently has been engineered by nonengineers. Improvements and refinements have been added by trained equipment engineers after the basic developments were proven in actual usage.

One of the most ingenious of these tools and one that added greatly to the improvement of welding is the internal lineup clamp. The internal lineup clamp is an expanding device that is fitted under the mating ends of the pipes and holds them firmly in place for welding.

The twin advantage of this device is that it eliminates the need for tack welds and helps level the mating edges, thus minimizing mismatch or, as we call it, "hi-low." The earliest model was a hand-cranked device in which a screw and lever arm forced shoe segments against the pipe inner surface.

Later developments introduced electric motive power, hydraulic pressure, and pneumatic power. The shoes also developed from a simple split band to the latest, having a large number of small round fingers acting in individual small surface areas. This latest clamp successfully rounds out adjoining edges to give a near-perfect welding groove.

But here's a word of caution regarding high-pressure lineup clamps. Any major rounding out of pipe in the field, where a permanent set cannot be achieved to hold this roundness, produces a locked-up strain in the stringer bead, in addition to the normal welding stresses. In welding the second bead, the strength of the stringer bead momentarily is reduced to a very low figure, at which time the superimposed bending stresses may instigate root bead cracks.

It is therefore a fallacy to believe that a pipe does not have to be perfectly round when it leaves the pipe mill. Pipe will crush slightly during shipment, but out-of-roundness at the pipe mill is almost inexcusable. Very little pipe in pipeline use has a diameter-wall ratio of a degree that it will not maintain roundness within itself.

Returning to the lineup clamp, and particularly to its use in welding of large-diameter line pipe, let's consider another hazard. As noted before, the lineup clamp does set up a strain in the pipe wall. Releasing the pressure causes a "springback."

We also have noted that weld metal has comparatively little strength until it has cooled below a critical temperature. From the study of metallurgy we also find that metal of line-pipe composition passes through a brittle stage at about 600° F.

Knowing these facts it readily can be seen that superimposed loads during these transition periods can instigate fractures. The external load caused by lowering pipe onto skids after welding or the locked-up stresses caused by springback may be sufficient to cause such fissures in those sections of a weld that have not passed through the transition temperature.

Knowing this, it is highly recommended that the tension of the lineup clamp be maintained until the root bead is completed and the pipe has been rested properly. The lineup clamp lends support against the shock of landing the pipe, and the time interval of the operation permits all sections of the weld to pass through the danger zones before the springback load is effected.

By observing these cautions much of the so called "under-bead cracking" trouble can be avoided.

Qualification of Process and Welders

Pipeline welding follows the methods of qualification set up in the Standard for Field Welding of Pipelines. Since the essential factors of pipeline welding vary from normal, procedure qualification is based on pipe size, wall thickness, bevel design, climatic conditions, etc., rather than in material groups as specified in other standards.

Pipeline procedures recognize only two groups of materials, both of which would normally fall into AWS Classification P-1. Normally one position is used in all qualification procedures. This is the "horizontal stationary," in which the weld groove is actually vertical and all positions are encountered.

Welder qualification is by far the most important consideration, since the pipeline welder is naturally more on his own in actual production. Although pipeline welding is divided into three separate operations as described previously, each welder is qualified on a complete weld.

His welding technique is observed and the test may be terminated before completion of the weld if the inspector feels that the weld does not meet standard requirements. Frequently such disqualification occurs during the preparation and welding of the root or second bead. A welder who is thus "looked out" cannot take another test. If the weld is completed and "looks" satisfactory, test coupons are cut from its periphery and subjected to tension, root and face bend, and nick-break tests.

Failures of physical tests within the acceptable limits of the standard may not cause disqualification, but most

often one specimen failure is sufficient for disqualification and only rarely is a welder given a second chance.

Welds also are cut periodically from the actual line and tested as prescribed above. A failure of any one specimen terminates the welder's qualification for the job and he is immediately released. This method of control tends to support the quality of each weld.

This practice is probably the chief difference between shop quality control and field quality control and makes the welder solely responsible for the quality of his welding. With such a practice it is little wonder that all welders must be specialists in pipeline welding. Nonexperienced welders seldom, if ever, can fit into a pipeline spread.

A special pipeline welders' union local has been set up for pipeline welders operating all over the country. This union takes precedence over all other welder unions, thus giving an interference-free reign to welders passing from one union control district to another.

Nondestructive Testing

Pipeline welding quality also is controlled by the much more searching methods of mondestructive testing. The "impossible" was achieved when radiography, both X-ray and gamma ray, were adapted to field conditions. At the time X-ray was first considered, the equipment was monstrous and most X-ray engineers shook their heads at the idea. However, the required equipment was developed on a principle far removed from that then in use.

The X-ray tube and necessary electrical complement were made smaller without reducing the power and the whole apparatus, except the controls were incased in a "pig". This pig then was mounted on a carrier, and with a power tractor attached, was ready to be run inside pipe 20 in. and larger in diameter.

Later models were made to go into pipe 12 in. in diameter. Sundry ingenious appurtenances made it possible for the pig to travel as much as a quarter-mile through a solid welded line, stopping to radiograph each weld and then coming back out again.

As isotopes became available, they also were adapted to pipeline radiography. First the isotope of cobalt, then iridium, and later cesium. Other isotopes also are being explored.

Inprovements by radiography . . . Not only has radiographic equipment been taken to the field, but also to the processing laboratory. Dark room, developing tanks, washing and film drying, and power plant all are mounted on a truck. This truck follows immediately behind the welders.

Very few minutes after the weld is completed, the welding inspector can look at the developed film and instigate the necessary changes. A pattern of defects or poor welding procedure can be discovered and corrected before reaching the state of rejected welding.

Recognizing the value of radiography, standards also have been developed covering radiographic technique, film processing, radiation safety, interpretations of film, and acceptability limits for defects.

It must be recognized that all welds are not perfect, homogeneous, and free of inclusions and voids, but neither is the steel plate of the pipe body. It also is recognized that all defects are not harmful to the same degree and that a certain amount of discontinuity can be tolerated.

Therefore, limits in tolerable defect sizes and distribution have been developed. Defects of a greater magnitude may be repaired if it is possible and economically feasible to do so, or the entire weld may be removed from the line.

The application of radiographic examination to welding has been phenomenal in the improvement of weld quality. As an example, we laid one line of several hundred miles before radiographic control was used, and experienced weld leaks on an average of one per mile.

In one section of 30 or 40 miles an even greater concentration occurred. On another line of 1,400 miles, using about 25% radiographic coverage, we found only six defects. This would prove that thorough radiographic coverage pays, regardless of the additional cost.

Other nondestructive tests . . . Nondestructive testing, however, is not confined to radiographic coverage alone. Magnetic inspection, ultrasonic inspection, dye-penetrant inspection, and pressure testing are playing increasingly greater parts in proving a pipeline before it is placed into service.

Recent developments in magnetic inspection and field tests of this method indicate that major defects can be detected even if they are not visible or are subsurface. While this method is not as conclusive as radiographic inspection, it has the advantage of greater ease in application and greater speed of determination of results.

Using magnetic powder, the defects are located on the exact location of the weld for examination. The indications also can be preserved by transfer to an adhesive belt, thus producing a record quite similar to the radiographic film.

This application is still in an embryo stage, but it does have a bright potential and may compensate for its disadvantages by a greater coverage.

Ultrasonic inspection also has a potential use in weld inspection, but has not been developed for a truly successful application as yet. However, it does find an advantageous application in determination of pipe wall soundness and pipe wall thickness for installation of taps on other welding on pipelines in service. Here it can find laminations and dangerous conditions before the welder strikes an arc to the pipe.

It therefore provides a safety factor for pipeline personnel which has met with phenomenal acceptance in our particular operation. Ultrasonic inspection also has found its place in examination of piston shafts, crankshafts, flywheels, and other engine equipment, where defects are detected before actual equipment failure occurred.

Dye penetrants have been used in all types of inspection. Because of simplicity of application and rapid production of results, this method frequently is used in conjunction with repair welding to locate surface defects or to determine if defects have been completely removed by grinding and chipping.

Pressure testing, either hydraulic or pneumatic, is the old reliable proof test of any welded enclosure. It is being used in the final testing of cross-country pipelines, even when other methods of nondestructive testing have been employed.

New Developments

Pipelines are evermore stretching their slender tentacles to new oil and gas fields in mountains, under the oceans, into the frozen North, and to the steaming jungles of the tropics; to markets in all major and secondary cities of the nation. The large-diameter pipe of 20 years ago is now paralleled again and again by even larger lines, and the vast deliveries of today have only scratched the surface of the potential market. Pipeline transportation is a young giant that is just awakening, and the future will astound even the most farsighted of today.

What materials does this future hold? The low-alloy high-strength steels already are becoming part of the picture. Materials having high corrosion resistance definitely are needed for transportation of corrosive materials.

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minimum already is in the planning stage. Nonferrous alloys such as aluminum are being used experimentally. Plastics have appeared on the scene. Stainless clad steel may offer some advantages. Thus it can be realized that a wide chain of material is or will be available.

This all means new construction methods, new welding procedures, new handling, coating, engineering, investigations, and studies. Requirements of speed means more automatic equipment, more automatic welding, more stringent quality control.

Welding technique also is developing in many directions—new types of welding processes, new types of electrodes, new problems. All of these improvements are being studied by pipeline engineers and are being adopted as fast as they can be proven. The demands of the industry present real challenges to the engineering profession and the challenges are rapidly becoming realities, thanks to the awakening of the engineering fraternities such as the ASCE.

Codes—Standards

A growing industry must police itself to keep from going wild. The pipeline industry realized this and through various available agencies such as the American Petroleum Institute, American Gas Association, and others, has set up standardization committees to develop codes with reasonable safety standards to be followed in construction and operation.

Just to mention a few of these standards, all pipe is manufactured in accordance with either API Std. 5L for carbon-steel line pipe or API Std. 5LX for high-strength line pipe. These standards specify the chemical and physical properties of various grades of steel skelp and seamless pipe. They also control manufacturing processes and specify quality-control practices. They set forth test standards and limits of acceptability. Finally they provide a recognized identification mark.

Welding Controls

Welding controls are based on API Std. 1104, which gives detailed instruction on developing procedures, testing of welders, design and welding practices, nondestructive testing, and limits of acceptability.

Construction is based on ASA Std. B 31.1.8. This standard is the construction bible and guides the designer as well as field construction toward the building of safer, more economical pipelines and facilities. The standard covers all phases of construction and incorporates all other applicable standards and specifications.

Domestic Sideboom Makes Big Hit In Canadian Pipelining

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57-105

PROUD TO BE PART OF A PIONEERING INDUSTRY

BY JOHN M. CAMPBELL
University of Oklahoma

Here is a comprehensive discussion of Principles of gas compression

THE INCREASED VOLUME of gas handled on the lease has made it necessary for the production engineer to be familiar with the principles of gas compression. This involves proper utilization of existing equipment as well as an understanding of the quotations and specifications set up by compressor vendors.

The first consideration is usually the amount of horsepower necessary in the engine or engines. The second is the amount of this horsepower that may be transferred to the gas via the cylinder. The latter involves the number and size of such cylinders as well as their volumetric efficiency.

Where an existing compressor is being placed in a new service one is first concerned with the volume that can be safely handled with the existing cylinders and still work within the specifications set up by the manufacturer. In many such instances the capacity is limited by this factor rather than engine horsepower. Where a unit is being designed for a specific job the first step is normally the determination of engine-horsepower requirements. The size and number of cylinders are then chosen by the vendor so that this horsepower may be effectively utilized, for new compressors are sold on an engine-horsepower basis.

Engine-horsepower requirements . . . The engine horsepower depends primarily on the gas quantity, compression ratio, gas properties, altitude, and the energy losses within the compressor itself. The first step is to determine the horsepower needed to compress the gas and then apply an appropriate efficiency term to determine the necessary engine horsepower for compression alone. To this must be added sufficient horsepower to power the accessories.

The horsepower requirements for gas compression may be found from:

1. Theoretical compressor equations.
2. Enthalpy charts.
3. Suitable empirical graphs showing horsepower as a function of the primary variables.

Fig. 1 shows the theoretical compression diagram for a compressor cylinder. At point D it is assumed that the piston has completed its compression stroke and no gas remains in the cylinder. The change in pressure from D to A occurs at constant volume and may be assumed to occur instantaneously. P_1 is the suction pressure and the intake valve is assumed to open instantaneously, admitting gas at pressure P_1. At the end of the suction stroke A-B, volume V_1 has been admitted.

As the piston moves to the left the suction valve closes and the gas is compressed along path B-C. When the pressure reaches discharge pressure P_2, the discharge valve opens and the gas is forced into the high-pressure line, at constant pressure until point D is reached. The cycle then repeats.

The total cycle work is the sum of the four steps outlined above or:

$$W = W_{AB} + W_{BC} + W_{CD} + W_{DA}$$

$$W_{AB} = P_1V_1,\ W_{BC} = {}_{V1}\int^{V2} PdV,$$

$$W_{CD} = -P_2V_2,\ W_{DA} = 0$$

$$\text{or } W = P_1V_1 - P_2V_2 + {}_{V1}\int^{V2} PdV$$

$$= -{}_{P1}\int^{P2} VdP - {}_{V1}\int^{V2} PdV$$

$$+ {}_{V1}\int^{V2} PdV$$

from the calculus.

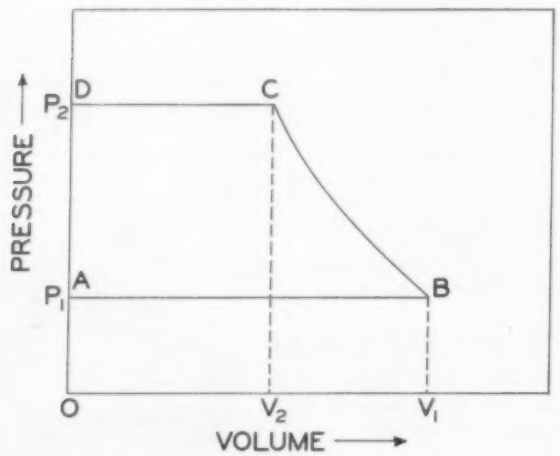
The first two terms cancel leaving $W = -\int VdP$. The total work therefore involves that in putting the gas in motion plus the actual compression step B-C. The latter is often known as the batch work.

This approach checks the derivation of the basic flow equations in Part 27 (OGJ, Feb. 4, 1957). These equations were:

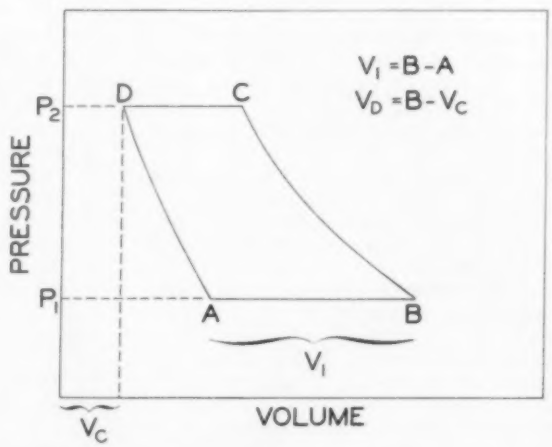
$$\int VdP = -W_f - W \text{ and}$$

$$\Delta H = q - W$$

where W_f represented the summation



THEORETICAL compression-cylinder cycle. Fig. 1.



THEORETICAL cycle showing clearance. Fig. 2.

of all irreversible effects, i.e., the inefficiency. In a theoretical cycle this term is zero.

For all practical purposes gas compression is adiabatic ($q = 0$). The water circulated in the jackets transfers little heat from the gas proper and does little more than keep the metal temperatures within reason. Any deviations from the true adiabatic condition may furthermore be incorporated in the efficiency term. The theoretical cycle may therefore be considered adiabatic and reversible. For this condition then:

$$W = -\int_{P1}^{P2} VdP = \Delta H \quad (1)$$

where ΔH equals the enthalpy change in an adiabatic reversible process. The work found from Equation 1 may then be divided by the over-all mechanical efficiency of the compressor to determine engine horsepower.

Obviously the piston cannot hit the end of the cylinder so that some gas must be left at the end of stroke C-D. This is shown in Fig. 2. The gas in this space then reexpands when the piston starts the intake stroke. The suction valve cannot open until the pressure of this gas has fallen to the pressure in the intake manifold. The volume V_C is known as the "clearance volume" and the ratio V_C/V_D the "clearance." This clearance "C" thus obviously limits the gas throughput per cycle. As it becomes larger more of the engine horsepower is used in simply recompressing this reexpanded gas.

For an ideal gas it is possible to derive the equation:

$$V_1 = V_D [1 + C - C (P_2/P_1)^{1/k}] \quad (2)$$

where $k = C_P/C_V$ (see Part 53 to follow) The ratio V_1/V_D is known as the theoretical volumetric efficiency, which is the ratio of the theoretical intake volume to the piston displacement.

Equation 2 limits in effect the maximum compression ratio in any cylinder (P_2/P_1). At some value of P_2/P_1 the expression in the brackets becomes zero. At this point V_1/V_D is also zero which means that no gas is taken into the cylinder, all of the horsepower being utilized for recompression. Although Equation 2 is not rigorous for an actual compressor, it does show that cylinder capacity depends on clearance and the compression ratio.

BOOKS

PETROLEUM REFINERY ENGINEERING. Fourth Edition. By W. L. Nelson. Published by McGraw-Hill Book Co., Inc., 330 W. Forty-Second Street, New York 36. 960 pp. $15.

This book by W. L. Nelson, who is technical editor of The Oil and Gas Journal, consulting petroleum and chemical engineer, and professor of petroleum refining, University of Tulsa, brings the art and science of petroleum refining up to date.

As were the previous editions of this work, this volume is both a text and a handbook for practicing engineers and technologists. It covers methods of processing petroleum, the design of refinery equipment, the evaluation of crude petroleum for the yield of products, the joint usefulness of products, and the cost of refinery equipment and its operation.

The importance of foreign crudes is recognized by the introduction of more information on foreign crude oils. Analyses of 70 foreign crudes are presented. Along with these, analyses of 90 representative United States oils are given.

Dr. Nelson has added the most significant factors of new processes, engineering practices, and cost data. Physical and thermal properties have been revised to include the latest products and information, including jet and rocket fuel.

For the first time, in a chapter entitled "Evaluation of Oil Stocks," the highly important subject of forecasting the physical properties of the products from the characteristics of the parent crude is explained.

OIL RESERVOIR ENGINEERING. By Sylvain J. Pirson. Published by McGraw-Hill Book Co., Inc., New York. 735 pp. $14.

This book includes everything that goes on in the reservoir until the oil arrives at the bottom of the wells, ready to flow or be filtered to the surface of the earth. It is divided into two parts: the first deals with static reservoir problems, and the second with dynamic problems.

The main static reservoir problem is the determination of the oil in place in a geological reservoir. This entails understanding such reservoirs, their mineral makeup and their structure; evaluating their pore space and their effective volume; measuring the reservoir fluid pressure and the physical properties of such fluids, as well as the fluid saturations.

The main dynamic reservoir problem is the determination and prediction of pressure, gas-oil ratio, and well-productivity variations. Fully worked-out example problems show how to make such predictions for the three fundamental oil recovery mechanisms.

The author is professor of petroleum engineering at University of Texas, and consultant in oil reservoir engineering and well log interpretation for various oil companies in Texas. He is the author of over 60 papers in the petroleum field.

PUMP OPERATION AND MAINTENANCE, by Tyler G. Hicks. Published by McGraw-Hill Book Co, Inc., 330 W. Forty-second Street, New York, 36. 275 pages. $9.

How to operate and maintain pumps used in industrial, municipal, central-station, marine, institutional, and similar installations is shown in this newly-published manual. It is planned to give what supervising engineers, operators, and maintenance personnel need to know throughout the life of the pump, from its arrival in its shipping crate until it has finished its years of useful service.

Every major class and type of pump is covered, with instructions for installing, starting up, routine operation, periodic maintenance, and major overhaul.

Recent advances covered include barrel-type centrifugal pumps, new operating and maintenance forms and scheduling methods, late developments in pump shaft metallizing, new sanitary pumps for food handling, new process-type centrifugal pumps, new chemical-type centrifugal pumps, and a large number of new metering and proportioning pumps.

The illustrative material includes photos, drawings, examples of procedures, a large number of operating and maintenance forms, and summary tables that show management personnel ways to keep track of pump operating and maintenance history.

DIRECTORY OF GEOLOGICAL MATERIAL IN NORTH AMERICA. Published by American Geological Institute, 2101 Constitution Avenue, Washington 25, D. C. $3. 208 pp.

The complexity of geological exploration, the diverse character of data upon which it is based, and the number of areas in which it is being carried on, have expanded greatly since 1946.

As a consequence, many new sources of information have come into existence, some old ones no longer exist, and many addresses have changed. For these reasons, a new, completely revised edition has been prepared and published as a special volume, giving the sources of geological information.

This second edition follows the general plan of the first, with a section listing sources of broad geographic and topical scope; and another section listing in detail sources of information available within each province or state, in which the data are of local application. Many sources of interest to geologists in mining and other branches of the science have been added.

EMULSIONS: THEORY AND PRACTICE. By Paul Becher. Published by Reinhold Publishing Corp., 430 Park Avenue. New York 22. 382 pp. $12.50.

Part of a series of chemical monographs for the American Chemical Society, the book is, in the words of the author, "an essentially self-contained discussion of modern emulsion theory and practices, with particular attention to the developments of the last 15 to 17 years."

The book begins with a discussion of the physical properties of emulsions as a function of emulsion composition, covers the theories of emulsion stability and deals with such manifestations of instability as inversion, creaming and complete demulsification.

The last half of the book introduces the more practical aspects of the field, discussing the chemistry of emulsifying agents and of emulsifier efficiency as a function of composition. One chapter treats the technique of emulsification, another covers the practical formulation of many emulsion types, and the last deals with commercial aspects of demulsification.

Two appendices include a discussion of measurements on emulsions and emulsion components, and a listing of commercially available emulsifiers.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

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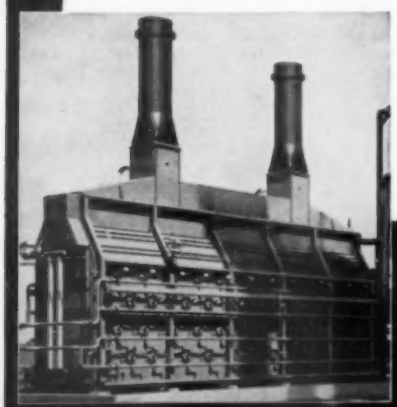

Selas multiple-coil Gradiation heater in Houdriformer service, producing high octane gasoline at Sun Oil Company, Ltd., Sarnia, Ontario, refinery.

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Water Costs—makeup, feed, process, and treated

BY W. L. NELSON
Technical Editor—Refinery Consultant

THE COST of raw surface water consists of little except the retirement of the investment in the land, the reservoir, and pumping equipment. When filters and storage basins are added as in industrial or municipal works, the cost becomes 0.5 to 1.95 cents per 1,000 gal. The cost of cooling water was found to range from 0.7 to 4.4 cents in Process Costimating No. 15, June 2, 1958, p. 139. According to Gilliland[7] the cost of industrial water ranges from 2 to 8 cents, and purchased water[8] from 6 to 20 cents.

Treating is very expensive (see Fig. 1), but treatment is usually justified for boiler feed water, process water, and in many cases tower makeup water. The points on Fig. 1 indicate treating costs reported in the literature and the lines are based mainly on the costs of demineralization by the use of ion enchangers. Treating costs are a function of the hardness of the raw water, the degree to which impurities are removed and to some extent the kinds of impurities. Thus, the lines of Fig. 1 are somewhat maximums which range toward lower costs with waters rich in weak acids, or high in alkalinity.

APPROXIMATE COST of water treating including all costs except that of raw feed water. Fig. 1.

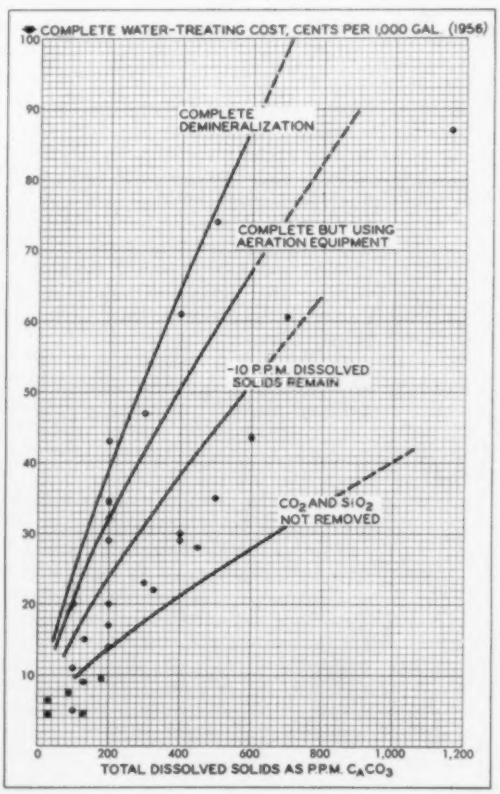

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TABLE 1—APPROXIMATELY COST (1956)* OF WATER—RAW, CIRCULATED AND TREATED.

	Cents per 1,000 gal.	Reference,
Raw—from streams or sea	0.1-1.1	10
Raw—at reservoir†	0.5-1.95	6
Agricultural water	0.5-3.0	7
Ground water (wells)	0.6-4.0	3
Cooling tower—cheapest	0.7	9
Cooling tower—average	1.7	9
Cooling tower—expensive	4.0	9
Industrial water	2.0-8.0	7
Purchased water	6.0-20.0	3
Treating—average—100 ppm‡	11.0	Fig. 1
Treating—average—200 ppm‡	18	Fig. 1
Treating—average—500 ppm‡	39	Fig. 1
Household, delivered	20-60	7
Completely dimineralized—200 ppm‡	32	Fig. 1
Completely demineralized—500 ppm‡	60	Fig. 1
Electric membrane—1,200 ppm	50	8
Electric membrane—5,000 ppm	100	8

*Converted to 1956 costs when necessary. †Cost of reservoir, pumping station, solids filtration, and storage basin. No delivery or profit. ‡Does not include the cost of raw water.

TABLE 2—MISCELLANEOUS COST INFORMATION (1956).

	Unit	Cost	Reference
Wells—300 ft.	$/foot	2.00	10
Wells—1,200 ft.	$/foot	7.00	10
Wells	$/g.p.m.	13-130	3
Well, equipped for pumping	$ each	11,700	4
Well, pumping	ct./1,000 gal.	.0.5-3	10
Reservoir, 10,000 acre-ft.	$/acre ft.	300-420	6
Reservoir, 20,000 acre-ft.	$/acre ft.	210-300	6
Treating plant labor	ct./1,000 gal.	0.06-0.29	10
Algae treating agents	ct./1,000 gal.	0.01-0.06	1,2,5
Cooling towers	(See costimating series)		11
Treating plants	(See costimating series)		11
Refinery water lines and valves	$/g.p.m.	21-31	10

The REFINER'S NOTEBOOK

Determining oil content

is the first step towards proper disposal of industrial waste water

BY C. K. RICE

AT PRESENT, the best method that is available for the determination of oily matter is the method given by API under designation 731-53 and by ASTM under its designation D 1340. This is the reflux distillation, extraction method.

The sample is refluxed through a trap which collects the volatile oil, measured volumetrically. The bottoms from this distillation is extracted with successive portions of a solvent. In the case of the API method, the use of benzene is mandatory. In the case of the ASTM method, a choice may be made among benzene, chloroform, or carbon tetrachloride.

After separation of the hydrocarbon solution, the volume is reduced by rapid distillation and then further reduced by complete removal of the solvent. The residue is subsequently cooled and weighed as oily matter.

Error . . . By this method, the error is claimed to be less than 10% of the oily matter present, boiling above 90° C., when the cut point between the volatile and nonvolatile oily matter lies in the range of 230°-260° C. If the initial reflux-distillation step is omitted and the procedure applied, starting with extraction, similar accuracy is attained for oily matter boiling above 150° C.

In addition to gasoline, fuel oil, and other hydrocarbons, substances such as alcohols, phenolics, organic acids, and others are also measured. In the case of the API method, a correction is made for organic acids that might be present. ASTM does not provide for this correction.

The method just described is based on a method developed by the Standard Inspection Laboratories of the Esso Standard Oil Co. and the Sun Oil Co.

Author is coordinator, refinery technology laboratory, Gulf Oil Corp., at Philadelphia. Paper was presented at WPRA waste-disposal symposium at Wichita.

In "Standard Methods," the method of test given is a petroleum-ether extract method.[1] It is claimed that this method avoids most errors that can affect the determination of oil and grease and that it should produce satisfactory results when small amounts of oil or grease are present. It is an extraction-evaporative method.

It is recognized in this method that solvents vary considerably in their ability to dissolve oil and grease as well as other organic substances. It is stated that no solvent is known that will selectively dissolve only oil and grease. Modifications of this method, as given in this same publication, are simply differences in the methods of extraction.

In discussing the precision and accuracy of the method given in "Standard Methods," examples are cited for hydrogenated vegetable oils (synthetic fats such as "Crisco"). It is doubtful that the conclusions reached on this basis are of much value so far as the wastes from a petroleum refinery are concerned.

Wet extraction not so accurate . . . It has been claimed that the wet-extraction method published in "Standard Methods" is a fast, accurate, relatively simple procedure employing standard apparatus available in any testing laboratory. The method is much faster than the API and ASTM methods and certainly involves the use of relatively simple apparatus. However, the claim for accuracy is seriously doubted.

Based on work that has been done by a number of petroleum refinery laboratories, the accuracy by this method for any but high-boiling oily matter is inferior to that obtained by the API or ASTM method.

Light HC loss . . . The wet-extraction method is not suitable for the determination of oily matter in refinery waste water because of the loss of light hydrocarbons incurred in evaporating the solvent. In addition to this, the method specifies, "petroleum ether." This is a rather ambiguous term to use. In checking the catalog of a large laboratory supply house in this country, it was found that three solvents varying in boiling range from 20°-40° C. to 30°-75° C. are sold under the name "petroleum ether." It has also been the experience of some investigators that different lots of so-called "petroleum ether" may contain from 0-15% aromatic material. Such variations will certainly change the solvent power of the "ether" considerably.

It would certainly be avisable to find a cheaper, faster procedure than the present API or ASTM method. However, it is doubtful that a method patterned after this wet extraction method would provide the proper solution to the problem.

pH

In almost any publication containing methods of test for industrial waste water adequate methods are presented for the determination of pH by the glass-electrode method.[2,3,4] All of these publications present essentially the identical method. In some cases, colormetric procedures are also included, but these are not particularly applicable to industrial waste.

The pH value of industrial waste water may be of considerable importance in some cases. It is a quality of the effluent from an industrial plant that is frequently scrutinized carefully by state regulatory agencies.

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Where other means of transportation are impractical, slurry pipelines are providing a . . .

New way to move solids

The gilsonite line is one of the first major cross-country solids-handling pipelines now in operation. There exists a much greater potential for this means of transport, particularly where large tonnages are to be handled, or where other means of transportation are impractical or too costly. Each case will require very careful analysis of the many factors to be considered. Factors controlling the design of the gilsonite line were few, and fortunately adequate safety factors could be provided for all those not completely defined in pilot tests.

BY JOHN H. HENDERSON, JR.
American Gilsonite Co.
Grand Junction, Colo.

A SLURRY PIPELINE has been operated for more than a year by American Gilsonite Co., owned jointly by Standard Oil Co. of California, and the Barber Oil Corp.

This 6-in., 72-mile line carries over 700 tons of gilsonite per day from mines located in a remote section of eastern Utah to a refinery near Grand Junction, Colo. There the solids (a natural hydrocarbon) are separated from the carrying agent (water), and refined to high-purity electrode coke and motor gasoline.

The first 170,000 tons handled at a current out-of-pocket expense of 2.5 cents per ton-mile is the best evidence of the efficiency and reliability of this new transportation method.

The ideal location of the refinery was near Grand Junction; however, the truck haul over all-year highways would have been almost 200 miles. Geographically, Grand Junction lies only about 80 miles from the Bonanza mines, but beyond the Bookcliff Mountains, which rise from 8,500 to 10,000 ft. above sea level.

A study showed clearly the economic advantage of the pipeline over other means of transportation. Relative to trucking, savings of over $4 per ton in over-all direct operating cost could be realized, amounting to about $1,000,000 per year, and easily justifying the additional $2,000,000 investment required for the pipeline system.

Design vs. Actual Operation

The design basis for the system contemplated a pump volumetric efficiency of 88% required for a minimum pumping rate of 325 g.p.m., a solids concentration of 35% resulting in 700 tons per day, friction significantly above that of water resulting in a station discharge pressure of 2,300 psi., and some attrition of particle size in transit.

Digested from a paper presented at the annual pipeline conference, division of transportation, API, at New Orleans, under the original title, "Design and Initial Operation of the Gilsonite Slurry Pipeline."

Actual operation shows a volumetric efficiency of 95% resulting in a pumping rate of 350 g.p.m. with a solids concentration of 32.5% required for the design amount of 700 tons per day. Concentrations as high as 40%, or 850 tons per day, are regularly handled with no loss of volumetric efficiency.

The friction factor is approximately that of water so that the station discharge pressure is 2,150 psi. at the increased pumping rate. Attrition is negligible and the slurry is easily filterable with 100% recovery.

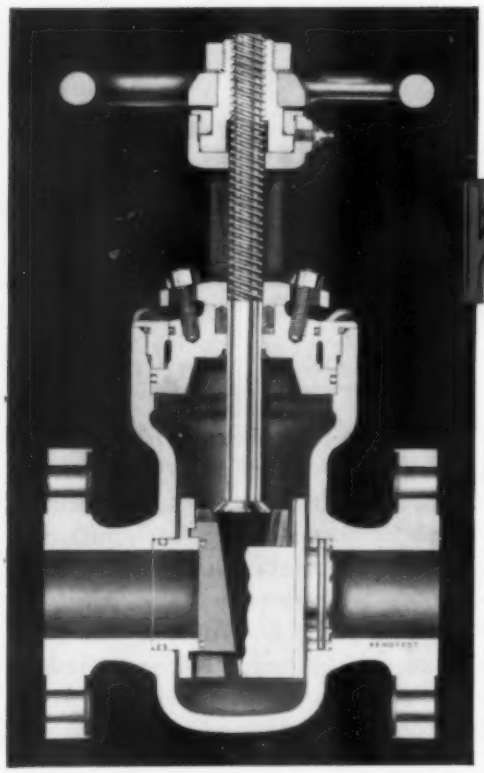
The maximum particle size to be allowed in the feed slurry was of extreme importance. Fortunately, gilsonite is a relatively friable material and easily crushed with fairly uniform distribution of all sizes. It was found possible to pump slurry with conventional positive-displacement pumps, with a ¼-in. top particle size. However, improved volumetric efficiencies were obtained when an 8-mesh top-size feed was used.

Another advantage in the smaller particle sizing was reduced degradation, caused, we believe, by abrasion of the larger particles against the pipe wall and against each other when subject to the turbulent-flow conditions in the pipe. Although it would appear to be directionally wrong, the smaller top-particle sizes appear to create less fines in the effluent, thus making dewatering easier.

Finally, as one might expect, smaller particles are easier to maintain in suspension. The gilsonite pipeline is designed for no more than 5% of the particles to be in the 4-by-8-mesh range. This control is still used, and the volumetric efficiency of the pumps does not appear to be affected adversely by this amount of "large" particles.

Pressure drop-flow velocity . . . The pressure drop-flow velocity curves obtained in the pilot tests showed the same characteristic form found in published reports by other investigators using heavier solids. Pressure drop was primarily found to be a function of flow velocity, approaching that of clear water at high rates, but as the velocity was increased, the pressure drop tended to be increasingly higher than the corresponding pressure drop for water until it appeared to level off and be substantially independent of the flow.

At the extremely low velocities, a uniform suspension was no longer achieved and flow became unstable. Pressure drop is also a function of particle sizing, solids concentration, and temperature. However, our testing was limited to a narrow range of these variables because of practical considerations.



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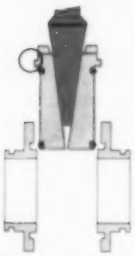
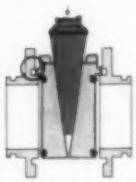
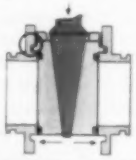


Valve fully open. In closing, discs and spreader move down, perpendicular to flow.



Discs are positioned without drag across seat. When disc lug rests on seat ring, continued downward motion of spreader moves discs parallel to flow.



Valve fully closed. Spreader holds discs bubble-tight against seat rings. When opening, seated discs are retracted with the same parallel motion – again with no drag against seating surfaces. The upward motion does not begin until discs are clear of seat ring.

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Demonstrating effectiveness of upstream and downstream seating on KEROSEAL Valves—with end flanges blanked and valve fully opened—pressure built up (hydraulic oil)—Figures 1-2-3 follow.

The valve was closed, resulting in three separate pressure chambers; i.e., body cavity between seats and two port cavities.

Pressure released in body cavity (center gauge now reads zero). Pressure remained constant in each port cavity.

Pressure released from bottom port cavity of valve. Top port cavity remains at constant pressure.

The principal aim was to establish a minimum safe velocity. This was determined to be 3.4 ft. per second, the point below which the exponent in the velocity-pressure drop relationship began to change. The minimum wall thickness of our 6-in. pipe is 0.188 in., so the design pumping rate of 325 g.p.m. was established to give this minimum velocity in the largest internal-diameter section.

Establishment of an adequate minimum design velocity was, of course, of the utmost importance, to insure that none of the particles be left behind and eventually plug the line or cause substantial increase of the pressure gradient.

The test work indicated the friction factor of the slurry to be somewhat above that of water. The pressure gradient used as a design basis was set at 25% above that established by the test work in order to give a reasonable allowance for variables that could not be fully explored. This resulted in the use of 0.375-in.-wall-thickness pipe at the Bonanza end of the line and a design pressure and pumping capability of 2,500 psi.

Actual operation of the line shows the pressure gradient to be about that of water. Deterioration of the internal pipe surface is not expected since the test work showed that the slurry particles will keep the wall clean. Also, of course, corrosion-inhibiting chemicals are used.

It has been definitely established by sharp water-slurry interfaces and scraper runs in water batches that no particles are left behind.

Pump volumetric efficiency . . . On the basis of test work done at the pump manufacturer's plant, a pump volumetric efficiency of 88% was established for the design basis. This figure was, of course, strongly influenced by the type of valve used. A spherical steel valve working against a narrow seat made of a hardened insert was found to give hope of longest valve life.

Actual operation shows a volumetric efficiency of 95% can be maintained for a period of 4 weeks between valve changes and up to 8 weeks between seat changes. No valve cleaning is required. The usual reason valves must be changed is failure of the surface, with wire drawing in small grooves.

Seats fail in much the same way. However, this length of time between changes is so much better than was anticipated, and the cost of rebuilding so slight, that what was feared to be a major problem turned out to be no problem at all.

On the Job

PIPELINING

Solids concentration . . . The pilot tests demonstrated that gilsonite slurries containing up to 40% solids by weight could be successfully handled. It is obvious that the line could be rapidly gotten into serious trouble by injection of substantially higher concentrations.

On the other hand, establishment of too low a concentration would waste water and power (both quite expensive in eastern Utah). A concentration of 35% was chosen for the design basis, and provision made in design of the slurry-preparation plant to insure that the concentration could be tested before shipment.

Actual operation has occurred at concentrations as high as 42%. There are indications that the volumetric efficiency begins to fall off at about 41%, but this has not been fully explored. At 40% and below, there is no noticeable variation in either volumetric efficiency or pressure gradient with concentration.

Erosion and corrosion . . . Unlike many mined ores, gilsonite will not abrade steel surfaces. It is completely insoluble in water and is naturally free of impurities. Practically no erosion or corrosion allowance has been provided in establishing wall thicknesses for the pipeline.

The pipeline is designed to operate with a pipe-wall stress of 65% of the yield strength. However, the minimum thickness is ⅛ in. To be assured that metal loss would not be a problem, California Research Corp., a subsidiary of Standard Oil Co. of California, developed an interesting method of determining metal wall losses by using a small section of pipe in the test loop made radioactive in an atomic pile.

By carefully measuring the minute amounts of radioactive iron worn away with the slurry, corrosion rates were established in just a few hours of operation.

Pressure control . . . Bonanza is at an elevation of 5,700 ft.; the summit, Baxter Pass (Milepost 36) is at 8,500 ft.; the refinery (Milepost 72) west of Grand Junction is at 4,500 ft. It was believed prudent to keep the line "packed," or under pressure, for its entire length.

Since the average ground gradient from Baxter Pass to the refinery is much steeper than the hydraulic gradient, substantial throttling is required

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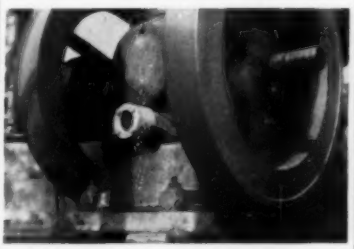

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at the refinery. For 350 g.p.m., an incoming pressure of 1,200 psi. is maintained by running the slurry through a 1½-in.-diameter choke tube, followed by an angle-type throttling valve for minor adjustments. This results in a 75-psi. pressure at Baxter Pass and 2,150 psi. at Bonanza.

Freezing . . . The pipeline has been installed with 3½ ft. of cover to prevent freezing. However, there are two exposed 800-ft. suspension bridges over canyons. These are insulated to protect them from freezing for a 24-hour shutdown. Beyond that time, they would be drained.

Attrition of particle size . . . The filter design was conservatively based on the test-loop attrition. Actual operation shows little attrition. The slight increase in minus-200-mesh particles probably occurs largely in the pressure breakdown system.

Continuity of flow . . . The pipeline is designed for continuous flow and will only be shut down after all slurry is flushed from the system with water. Three electric-driven slurry pumps have been provided at the pump station, any two of which can maintain the established minimum flow. This allows one unit to be down for maintenance.

In the event of a power outage, a diesel-driven water pump, capable of flushing the system with water at the required flow rate, will be automatically cut into the pipeline.

A water reservoir capable of automatically flushing the entire line has been provided at the high point in the system. Fortunately, the reservoir is high enough to maintain the required flow velocity by gravity simultaneously in both directions until the system is entirely clear of slurry.

It is also possible to make use of a high-pressure water pump installed in one of the processing plants at the refinery for back-flushing the line. The pilot test showed that if adequate velocities were maintained, slurry could be continuously circulated through the system without buildup of solids or other evidence of malfunction.

The test loop could frequently be shut down with slurry remaining in the pipe and restarted again. However, occasionally it plugged. Therefore, it was considered mandatory to provide for continuous operation.

It has been necessary to flush the line from Baxter Pass for up to 1 hour several times due to equipment failures at one end of the line or the other. It is certain that the cost of the reservoir has already been paid out by avoidance of plugs by settled solids.

Pump Station

The gilsonite is pumped from the mine whenever mining is being done. It arrives above ground at the slurry preparation plant where it is screened, crushed, desanded, and a portion mixed to the right concentration for pipeline shipment. The remainder is stockpiled to provide continuous pipeline feed when the mine is not operating. The cleaned, proportioned slurry is pumped in to the pipeline by the two operating 300-hp. plunger pumps. There is no intermediate booster station. The throughput could be doubled by construction of a booster station.

Operating Expense

The operating expense can be broken down into two categories: that which is proportional to distance, and that which is not. Current out-of-pocket expense (excluding depreciation and prorated general administrative costs) per ton is:

Item—	Cost per ton	Cost per ton-mile
(a) Not proportional to distance:		
Slurry preparation	$0.43	$0.0060
Dewatering at refinery*	0.40	0.0056
Subtotal	$0.83	$0.0116
(b) Proportional to distance:		
Pump station	$0.79	$0.0110
Pipeline	0.14	0.0019
Subtotal	$0.93	$0.0129
Grand total	$1.76	$0.0245

*After credit for water supplied to refinery.

Note: (1) Costs based on first few months operation. (2) Costs can be decreased by higher throughput, improved efficiency, and increased operating factor.

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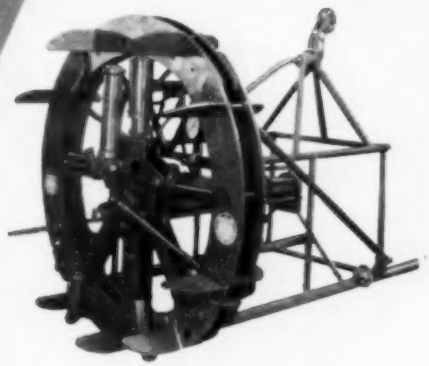

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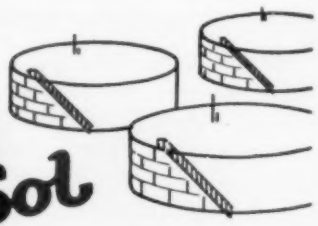

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The BEST gives you *Economy* too!

When you figure economy in terms of results obtained per dollar spent, you'll find that H. C. Smith Rock Bits are right up front. For many drillers can tell you that they make more hole – faster and straighter – with H. C. Smith Bits.

There are good reasons why!

COMPACT BODY DESIGN gives H. C. Smith Bits greater clearance between bit and hole wall . . . more room for return circulation to sweep away bit cuttings. Bit teeth stay on bottom, making hole, not just grinding up cuttings. *That's economy in time!*

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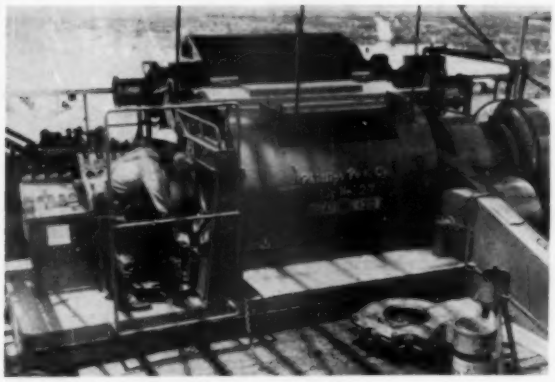
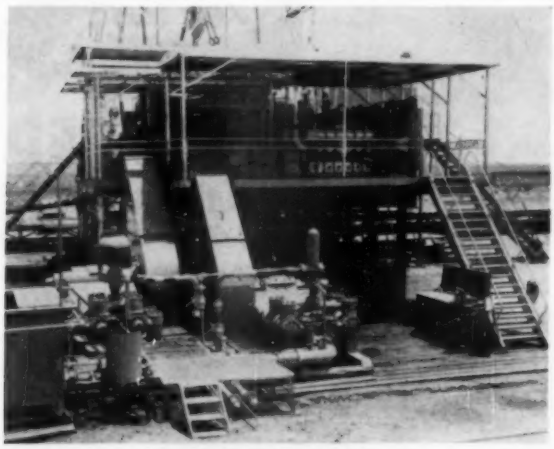


Drilling Ahead . . .

in world's deepest test, Phillips Petroleum Co.'s 1 EE University, near Fort Stockton, in Pecos County, West Texas. At the controls is C. J. Land, driller. Shown is the rig's Micromatic drilling control and National 130 draw works. Hole is near 23,000 ft. after passing previous drilling-depth record of 22,570 ft. (The Oil and Gas Journal, June 2, 1958, p. 63).



On record-depth well . . .

the circulatory system included two large slush pumps (National E-700 and C-350), driven off the compound powered by three Le Roi gas engines. Partly visible in the background is the rig's 18-ft. substructure for its 136-ft. derrick. A mud tank is at the extreme left.

Who's getting the drilling contracts

Dorris Ballew, Inc., Natchez, Miss., is making hole on a new deep contract operation in Glades County, in southern Florida. Drilling is for Amerada Petroleum Corp., whose location is 3 miles east of Palmdale and about 10 miles west of Lake Okeechobee. It is about 45 miles north of Humble Oil & Refining Co.'s Sunniland field, the state's only production. Spot location is at 1 Lykes, in 1-41s-30e.

Chance Drilling Co., Houston, is going back to the Rioux area, east of Raceland, in Lafourche Parish, southeastern Louisiana, for another well it has contracted to drill for Union Oil Co. of California. The new operation, at 2-L LL&E, is about 1,800 ft. south of Union's discovery well, drilled by Chance, and completed last February with gas-condensate production from a 11,800-ft. sand. Discovery well was drilled to 13,500 ft.

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Write for descriptive price list.

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Lengths, 20, 25, 30 ft.

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ELECTRIC LOG FILE E-27

NEW, deep-drawer filing cabinet for reduced, electric well logs 6½" or less in width.

This 7-drawer unit is the newest addition to the quality KRAFTBILT line of log cabinets. Deeper drawers accommodate easily the wider, reduced logs. Each drawer will hold 600 reduced well logs. Total file capacity is 4,200 of the wide, reduced logs. Size and construction exactly like Model E-28.

Model E-28 Electric Log Cabinet

Model G-34, G-36 Strip Log Cabinet

Filing Supplies to fit perfectly are available for all KRAFTBILT units.

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Falcon Seaboard Driller Sets Safety Record

WHAT IS BELIEVED to be one of the all-time safety drilling records in the oil industry has been set by Cecil Hampton, driller for Falcon Seaboard Rig No. 15, now operating near Lindsay in McClain County, Oklahoma.

Hampton has operated a rig continuously through 1953, '54, '55, '56 and '57 without a single lost-time accident to himself or his crew.

Hampton was born in Webb City, Mo., schooled in Texas, and in 1919 started his oil career in the old K.M.A. field south of Wichita Falls, Tex.

He came to Oklahoma in 1929, and was made a driller in 1930 in the Oklahoma City field. He spent 22 years with Noble and Olsen drilling companies before joining Falcon Seaboard.

He lives with his wife, Marcia, and their two sons, Ervin and Jimmie, in Hennessy, Okla.

Offshore Co., Baton Rouge, La., has contracted for 13,000-ft. test Southern Natural Gas Co. proposes to put down in the Mosquito Bay area, in the coastal marshlands of southwestern Terrebonne Parish, Louisiana. Location, at 1 Nelson, in 12-21s-12e, is 1½ miles south of the field's two gas-condensate wells drilled in 1955 and 1956. Forest Oil Corp. drilled the discovery well, and Shell Oil Co. its offset.

Nuckolls-Bell Drilling Co., Oklahoma City, has a new contract operation in Logan County, Oklahoma. It is a 6,750-ft. test for Ryan Consolidated Petroleum Co. and Seneca Oil Co. at 1 Hirzel, in 36-16n-4w. Location is in wildcat area east of the spreading East Cashion field, and northeast of West Navina field.

Henderson Drilling Co. is the drilling contractor for a Matagorda County test 1 mile northwest of production limits of Buckeye field, staked by Michel T. Halbouty, Houston independent oil operator, geologist and petroleum engineer.

Halbouty's 1 L. V. Stoddard, a projected 12,000-ft. test, is ½ mile northwest of the town of Buckeye, Tex.

Justiss-Mears Drilling Co., Jena, La., has a contract for a 9,500-ft. test in Coupee field, Pointe Coupee Parish, South Louisiana. It is the Marlin Exploration, Inc., 1 Marion S. Monk in 38-3s-8e.

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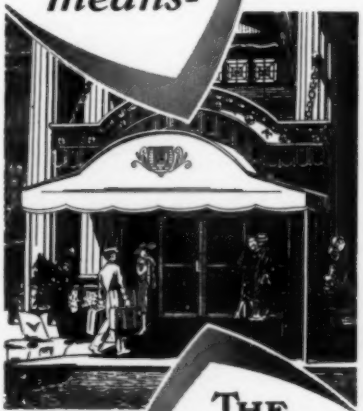

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The Cooper Self Propelled "T" and "TC" Model Rigs with the Cooper Skytop 66 ft. Doubles Derrick are the most completely portable big rigs built.

The Cooper Skytop 66 ft. Derrick will pull and rack pipe in doubles as fast, or faster than conventional 90 ft. derricks, yet it weighs thousands of pounds less and costs less. It has ample capacity for the deepest servicing or workover—racks over 13,000 feet of 2-7/8" O.D. pipe in doubles.

Fast and safe hydraulic erection—tong drive included at no extra cost.

Mast roading dimensions: length 35 feet, height 13 feet 5 inches or less, depending on rig, width 8 feet.

COOPER "T" MODEL RIG

The Cooper "T" Model Rig is built to take the roughest oil field service.

Engineered for proper weight distribution on all axles. Tandem front axles available where required.

Unitized vehicle and drawworks frame construction reduces weight and height, increases rigidity and stability.

Has every modern feature—torque converter and full torque shifting transmission. Quiet running torque tube drives that require no adjusting.

There are no high speed chains.

Hydraulic Power Steering—Air Brakes.

Big, comfortable cab, located away from well—is protected from oil spray—un-obstructed driver vision.

A wide choice of heavy duty industrial engines up to 300 horsepower, gas or diesel.

Big brakes—up to 42" diameter with 10" wide face—air and water cooled.

Full air drum clutches—self adjusting.

Cooper "T" Model Single Drum Workover Rig with Cooper Skytop Doubles Derrick on a deep workover job located on the Gulf Coast.

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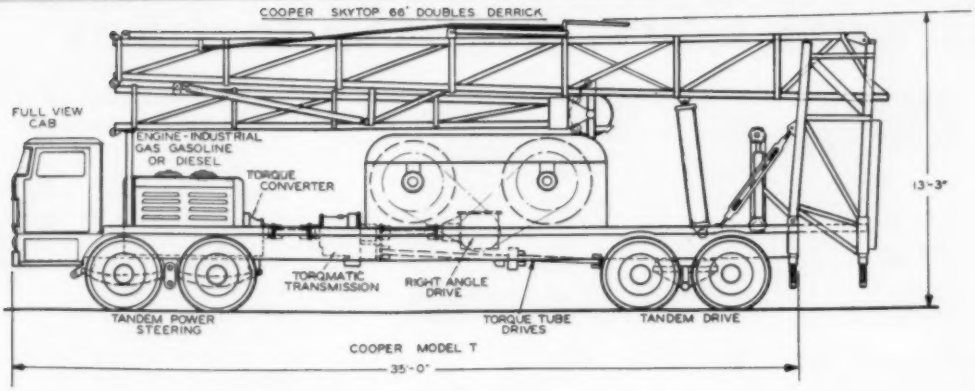

Cooper "T" Model Double Drum with Tandem front axles and Cooper Skytop Doubles Derrick in roading position.

COOPER TC MODEL DOUBLE DRUM WITH Cooper Skytop DOUBLES DERRICK

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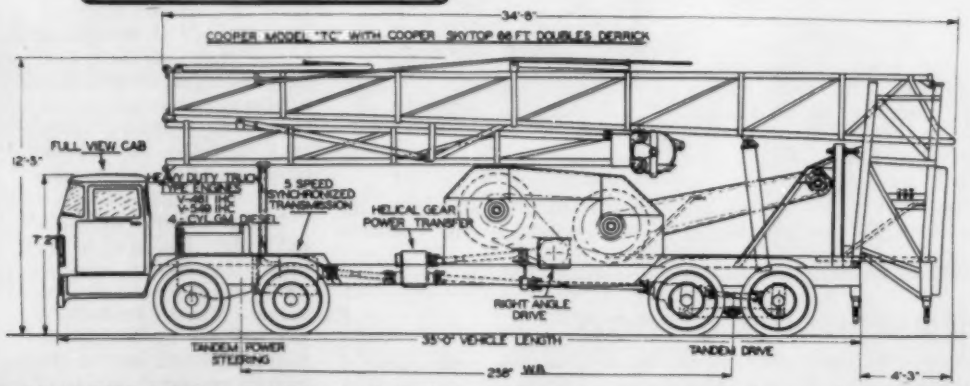

The Cooper Model "TC" Self Propelled Rigs are built for medium depth servicing and workover to 10,000 feet.

These sturdy rigs are designed to keep weight to a minimum so even in the Double Drum Model when equipped with the Cooper Skytop 66 ft. Doubles Derrick, no permits are required in most states.

Powered by light weight truck type engines such as the International V-461 or V-549, Gas-LPG V-eight, General Motors four cylinder diesel, Deutz eight cylinder air cooled diesel and Waukesha 140-GKU Gas-LPG, or other suitable engines.

Torque Converters with five speed synchronized transmission drives. Air brakes, big cab, single or tandem front axles as required, with power steering.

Full Air, Self Adjusting Drum Clutches.

Winch brakes water and air cooled in sizes to fit the job.

Cooper Rigs with Skytop Derricks are the most efficient and economical units for servicing, workover and slim hole drilling.

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This week's SHOWCASE features . . .

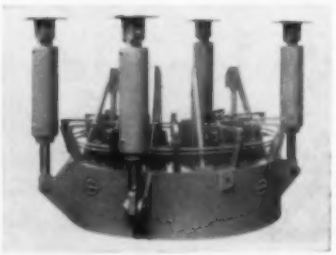
Work boat for offshore use

. . . made of glass-fiber-reinforced plastic. The hull, bulkheads, and cabin of the 35-ft. boat are molded of glass-fiber reinforced, fire-retardent polyester resin.

Twin GM 671 diesel engines power the boat. Compared with a steel boat of the same horsepower, length, and hull design, the plastic boat weighs about 4,000 lb. less and moves more than 6 miles per hour faster, the maker reports. **Write or call: Universal Moulded Products Corp., Bristol, Va., for details on plastic boat.**

Casing driver has hydraulic rams

. . . capable of exerting a downward force of 500 tons. It's used to drive large-diameter conductor pipe on offshore locations. To center the pipe in the bowl, or yoke, four casing guides are provided. These have removable guide plates to suit the size of the pipe being driven. Six hand-set slip units located on the upper surface of bowl are used during the run-in operation until the bottom will support the pipe weight. Adapters and



slip liners are provided to suit the specific size of pipe.

Twelve air-operated slip bodies are provided to do the driving. The driving slips are set only once. The spring effect of the air allows the teeth of the slip inserts to slip over the pipe without marring it. The driver eliminates the need for a special barge to set pipe previous to the arrival of the drilling barge. And it drives casing on center with the rotary table to eliminate the problem of getting exactly located on the drilling location and centering on the predriven pipe. **Write or call: Joe Stine, Inc., P. O. Box 14471, Houston 21, for details on casing driver.**

●

Tension type of tubing anchor

. . . maintains the minimum tension required to prevent tubing buckling and breathing, the maker reports. The Type HM2 anchor is run above the pump. It automatically engages the casing when pressure at the anchor reaches about 200 psi. It then moves freely down hole. But it prevents upward movement, maintaining the lowest level necessary to prevent tubing buckling and breathing.

The anchor sets automatically when fluid rises in the tubing. No surface manipulation is required to set the anchor. Two mechanisms will release it. When the pressure in and out of the anchor equalize, a spring moves a hydraulic sleeve up and contacts the lower end of the slips. The tubing is then lowered or jarred down to dislodge the head from the slips and unseat the anchor. The hydraulic sleeve spring then retracts the slips and permits removal. Tubing can then be pulled in a normal manner.

If the slips contact the casing and resist removal, a ring will shear. The result is an upward jar on the bottom of the slips. A positive release is thus achieved, assuring removal of the anchor.

The anchor is available for 5½ or 7-in. casing with 2 or 2½-in. field connections. **Write or call: Guiberson Corp., P. O. Box 1106, Dallas, for details on Type HM2 Tubing Anchor.**

Send this Showcase Coupon

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

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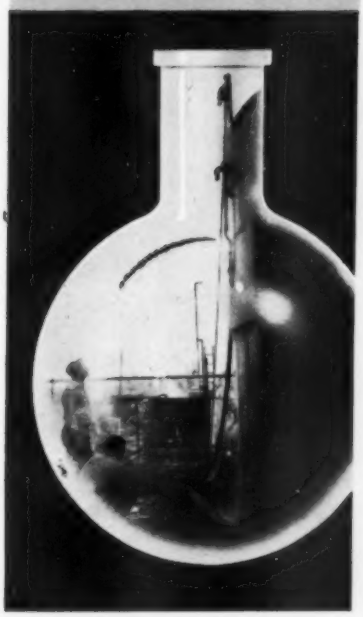

Best way to strip a tank exterior

STUDIES indicate that the best way to clean off all old paint from storage tanks is the Oakite ECP way . . . which recommends the *Hot Flow-On* method. At one refinery, jobs which took costly man-days of tedious wire brushing were completed in just a few hours by a two-man crew.

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Each Oakite ECP is backed by a *laboratory* concentrating on chemical cleaning research, by *materials* known to make short work of refinery soils, by proved *methods*. Send for Bulletins. Oakite Products, Inc., 44C Rector Street, New York 6, N. Y.

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Superior piston rod service is assured by heat treating the alloy steel plus precision finishing. Each Harrisburg piston rod is ground and polished to a perfect finish to assure exact tolerances and to reduce packing replacements. Threads and taper are precision ground and polished for the tighest possible rod and piston fit.

For corrosive and abrasive conditions, Harrisburg Super Chrome rods are recommended as they provide more than twice the service life of the non-plated rods.

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New pipe coupling tightens easily

. . . with one hand and without special tools. The high-pressure coupling is designed to bridge the gap between unions and disconnect couplings. It can be used where unions or flanged joints are currently used. The Matchline coupling is especially suitable in areas of difficult access, where flared fittings are used.

The coupling nuts are installed after the fittings are permanently attached. They may be removed easily and conveniently in either direction. Cross-threading is eliminated. Coupling-nut threads are fully engaged before a joint is drawn together. The coupling may be engaged and sealing accomplished even though coaxial misalignment may exist between line sections at the joint.

Sealing is accomplished within ⅛ in. of the bore of the tube. The coupling has been tested to 3,800 psi. It is available in all standard sizes. Operating temperatures range from 270° to 450° F. **Write or call: Task Corp., 1009 East Vermont Avenue, Anaheim, Calif., for details on Matchline coupling.**

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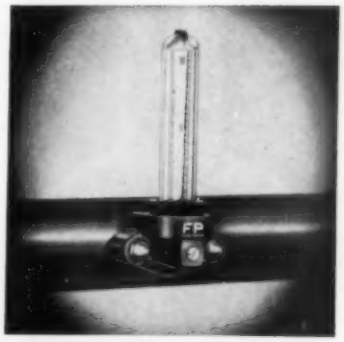
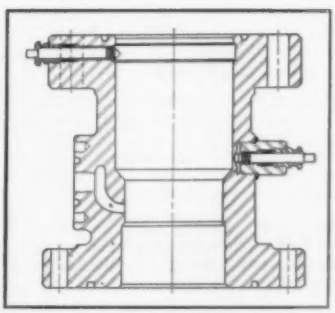


Meter measures flow either way

. . . in pipe sizes from 1½ to 8 in. without the use of additional components or accessories. The new corrosion-resistant flowmeter requires no flanges or matching orifice plates. It's easily installed in a few minutes.

Called the Mighty-I, its readings are made directly by means of a ball float and a linear scale calibrated in g.p.m. Scales covering flow rates from 3 to 30 to 200 to 2,000 g.p.m. are available. **Write or call: Fischer & Porter Co., 677 Jacksonville Road, Hatboro, Pa., for details on Mighty-I indicating meter.**

•



New head for suspension of casing

. . . and single, dual, or triple parallel strings of tubing has been developed. Known as the C-19-U head, the equipment also can be designed to allow the use of four parallel strings of tubing.

Use of the head in casing with a 7⅝-in. o.d. will allow the running

THIS BLOWOUT PREVENTER IS
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AND IT
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HOLDS PRESSURE!
Prevents blowouts when pulling rods. Shuts in the well while replacing stuffing box rubbers. Flat faced rams seal against all diameters from 0 to 1½". No packing glands to leak. Available in all thread sizes. Get the Double-E Blowout Preventer through your local supply store!
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Have Long Life and are Self-Regulating

Unlike other metals sometimes used for cathodic protection, zinc anodes have an expected life of a minimum of fifteen years. Zinc anodes are self-regulating and require no current regulating resistors to meet the load demand, whether high or low.

These are important reasons why American Zinc Anodes are first choice for cathodic protection in the oil and gas industry. Your inquiries invited.

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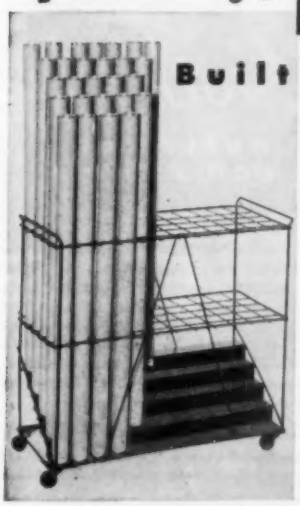
FRONTIER

MAP RACKS



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- HANDSOME
- COMPACT
- LOW COST

Welded all steel construction, ball bearing casters, the Frontier Map Rack saves time and space. Graducted steps provide easy visibility. Kraft wrapped tubes protect maps. Baked on black enamel finish.

Standard Map Rack—MR-160
60 openings, each 2½". Shipping weight — 29 lbs. 33" wide, 14½" deep, 32" high.

Other Sizes:
30 and 100 openings, each 2½". 36 openings, each 3½".

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FRONTIER MANUFACTURING CO.
11200 Harry Hines Blvd
Dallas, Texas

Versatile Emergency Jack Lifts 15 Tons at 4 Lifting Points

Lifting, skidding and leveling rigs; pushing, pulling and positioning machinery; supporting pipe and equipment are just a few of the oil field jobs done easily with the versatile Simplex No. 310A Emergency Jack. It handles full 15-ton capacity at four points; has 13" lift with minimum toe height of 2¼"; tilts on base for use at any angle.

Unique "Center-Hole" Hydraulic Units Pull . . . Lift . . . or Push in Any Direction

Pulling or installing cylinder liners, valve seats, pinions, bushings, wrist pins, keys, wheels, gears, etc. is fast and easy with a Simplex "Center Hole" Hydraulic Unit. Also serves as heavy-duty jack or hydraulic press. Remote-controlled and self-contained models in 10 to 100 tons capacity. "Center-Hole" tubular construction simplifies rigging, eliminates torque, makes pulling easier.

OTHER SIMPLEX OIL FIELD JACKS . . . include Lever, Screw and Standard Hydraulic types in a complete range of sizes and capacities.

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Miniature Jack for 50c!

This 3" high Simplex Screw Jack will lift 500 pounds two inches. Has all operating and construction features of larger screw jacks. Also is ideal desk ornament, paper weight. 50c ea. Shipped prepaid. Send cash or check to:

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GOTKOOL Water Cooler – made in 1½-, 2-, 3-, 5-, 10-, 15-, and 20-gallon sizes with either extended or recessed, flush-mounted faucet.*

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Insist on the genuine – look for the Blue and Black Label with the name "GOTKOOL" in Red.

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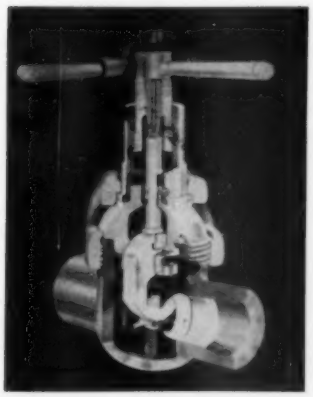
WINFIELD, KANSAS

of three parallel strings of tubing. A quadruple completion can be done using four parallel strings with larger casing. Switchover from a single completion to a dual or triple can be made without the time and expense of installing another type head.

Blowout preventers are not removed until all strings of tubing are in place in the well, thus insuring complete control throughout the completion operation. If three strings of tubing are run, all three hangers are grooved for back-pressure valves. **Write or call: Oil Center Tool Co., 1912 Airline Drive, Houston 12, for details on C-19-U head.**

●



New gate valve for mud-line use

. . . is now available for 2,000 and 3,000-psi. working pressures, in 2, 3, and 4-in. sizes and with either flanged or threaded ends. Called the Mud King, its simplified design and light weight make it easy to operate under pressure and fast to open and close, the maker says.

It can be disassembled and reassembled without tools. The coupling nut can be loosened with a hammer and unscrewed, leaving the body in the line. Then the whole inner assembly can be lifted out to expose the seat and gate for inspection. If the stem seal becomes worn or damaged, fluid shows at signal holes in the screw housing. A second seal protects the inner assembly from abrasives and corrosives.

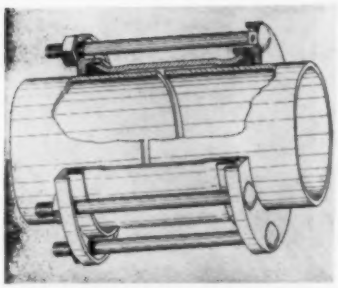
The valve is composed of a chrome-plated, alloy-steel gate, a specially compounded Buna-N seat with ductile-iron inserts, stainless-steel stem, and alloy-steel body. It's suited to the abrasive service of all mud-line applications, sand-frac, acidizing, and cementing operations. **Write or call: Drilling Equipment Mfg. Co., 845 Southeast Twenty-ninth, Oklahoma City, for details on Mud King gate valve.**

Compression coupling for aluminum

. . . pipe eliminates welding, threading, and modifying of pipe ends, the maker reports. The rubber gasket used permits enough expansion for most installations. It allows about ¼ in. of movement.

Perfect alignment of an installation is not necessary. The coupling allows a deflection of 6°, permitting pipe to fit the contour of the terrain.

Easy to install, the coupling requires no special tools or skilled labor. Special coatings can be used for added corrosion resistance. **Write or call: Corrosion Engineering Co., Inc., 209 Rice Professional Building, 2370 Rice Boulevard, Houston 5, for details on aluminum compression coupling.**



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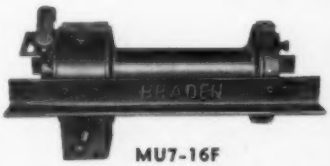
SPEED UP Handling Jobs

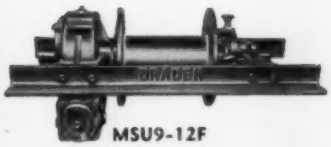
Time is important whenever there is a winching job to do. That's why you'll be time ahead with a dependable BRADEN winch on your trucks. BRADEN winches are designed to make haste safely. Finest materials and careful workmanship assure "ready-to-go" action on split second notice.

Ask your nearest BRADEN dealer for complete information.



MU7-16F

A front-end truck winch with rated capacity of 15,000 pounds. Easy to operate . . . long life . . . simple to service . . . new, streamlined designed.



MSU9-12F

The most powerful underslung winch in the BRADEN line with 20,000 pound capacity. Designed for behind cab or front-end mounting.

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BRADEN *Winches*

In service around the world

Flow-control valve for gas

. . . or liquid features simple design and sturdy construction. Each working part, except the cast-steel body, is made from stainless steel to protect it against corrosion. A straight-line increase of flow is controlled by a plug type of proportioning valve. The stainless-steel, self-centering, O-ring-sealed seat eliminates any possibility of eccentricity and is easily replaced.

Removal of the threaded type of stuffing-box cap makes all parts easily accessible for inspection or replacement. A Teflon sleeve packing gland provides a tight seal and requires no lubrication. With a 2,000-lb. w.p. body, the valve is available with a 1-in. through, 1-in. angle, 2-in. through, or 2-in. angle body. **Write or call: Merla Tool Corp., P. O. Box 2576, Dallas 21, for details on Type A flow-control valve.**

●

Automatic injector controls

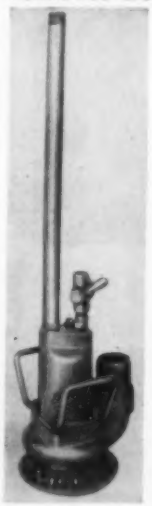
. . . batch-proportioning operations. A pump-meter combination, it permits homogeneous on-stream blending, according to the maker. Potential uses include adding TEL, injecting solvent and catalysts, feeding lubricants, controlling acid wash, treating boiler feed water, reducing ion content of water, and adding antifoam and coagulation agents.

The injector pump is a double-acting piston type. It is actuated by a rotary, positive-displacement meter. The meter accurately records the total gallonage. And it energizes the pump at intervals to automatically inject a controlled amount of additive.

Pump adjustment for quantity is controlled by a dial. The dial can be locked into position and sealed. Dial changing does not alter the piston stroke. Instead, it increases or decreases the volume of the pumping chamber. Pump pressures go to 100 psi. Capacities range from zero to 50 cu. in. per 100 g.p.m. A three-phase, totally enclosed, explosionproof motor drives the pump. Available meter sizes are 2 to 8 in. **Write or call: Granberg Corp., 1308 Sixty-seventh Street, Oakland 8, for details on automatic injector unit.**

●

Sump pump removes 200 g.p.m.



. . . from tanks, excavations, ditches, sewers, basements, manholes, or other shallow places. Called the 51-T, the pump is designed for lowhead pumping. It weighs 35¾ lb. Its nonclogging design makes the pump suited for removing clean or dirty water, oil, sludge, and other fluids.

A four-blade rotary air motor powers the pump. Less than 50 cu. ft. per minute of compressed air is needed under full load. The pump comes in nonsparking bronze models for pumping corrosive, inflammable, or other liquids in petrochemical plants and refineries. **Write or call: Thor Power Tool Co., Prudential Plaza, Chicago 1, for details on 51-T sump pump.**

●

Split-channel conversion kit

. . . adapts Motorola mobile two-way radiophones sold since 1949 to split-channel operation. Estimated conversion time for an average technician is a maximum of 20 minutes for any Motorola mobile or base-station model with a minimum of test equipment and shop facilities.

The complete line of conversion kits for Motorola equipment manufactured since 1949 is now available.

CM1

TRADE MARK
TIME TESTED
MACCO
GAS LIFT
REG. U.S. PAT. OFF.

MACCO DUAL COMPLETION EQUIPMENT
"Capsule" Mandrel and CM1 (1" O.D.)
Gas Lift Valve

The "capsule" type mandrel is available from stock for all standard dual, macaroni, and slim-hole lift. Special sizes are manufactured upon request. With the valve and check valve mounted inside, this type of mandrel provides extra large flow areas for the well fluids. The producing zones of parallel or concentric dual completions may be simultaneously lifted by either a "common" or "separate" gas supply. Macaroni tubing lowered inside of the regular tubing has proved a highly successful means of lifting wells where it is objectionable to pull the regular tubing. Efficient lift inside of small liners is also made possible.

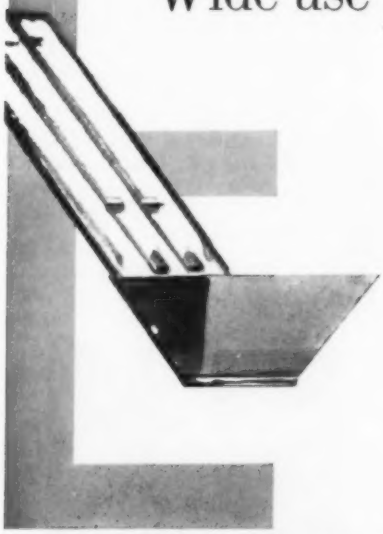
The Macco fluid operated valve is particularly suited for dual completion lifting. A typical installation consists of separate, parallel strings of tubing, each equipped with Macco fluid operated valves mounted in capsule mandrels. The fluid of each zone controls the opening and closing of its valves. The casing annulus serves as the gas supply for each string of valves. Valve interference is eliminated and each zone is lifted independently of the other. No surface equipment other than a choke in the gas input line is needed.

Macco manufactures many different types of dual completion equipment to fit any well requirement. For further information, write for Brochures No. 3-12, 3-21, and 3-31.

MACCO OIL TOOL COMPANY, INC.

1521 Prince P. O. Box 7288 Houston 8, Texas
Phone UN 1-1253

Wide use proves SANDOIL's big E



FRACTURING EFFECTIVENESS

FRACTURING ECONOMY

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Halliburton's SANDOIL Fracturing Process has been EFFECTIVELY used on a greater number of oil and gas producing formations than any other fracturing treatment.

SANDOIL is ECONOMICAL on any size fracturing job because inexpensive readily available crude or special refinery cuts and blends are used as the base fluids. Returns are saleable.

SANDOIL is EFFICIENT for a wide range of applications ... can be easily modified with Halliburton chemicals to help prevent emulsions and control fluid loss.

For further information ask for your free copy of the new revised "Elements of Hydraulic Fracturing."

HALLIBURTON OIL WELL CEMENTING COMPANY

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THE PIONEER IN FRACTURING SERVICES

Write or call: Motorola, Inc., Communications and Industrial Electronics Div., 5401 West Augusta Boulevard, Chicago 51, for details on split-channel conversion kits.

●

Two-way radio uses no tubes

. . . and can be carried by hand. The portable transmitter-receiver for use in VHF mobile communications is expected to be especially valuable to pipeline and utility companies in inspection work done by crews patrolling pipelines and wire lines to check for damage, the maker reports.

Completely transistorized, the unit is lightweight and compact. Its high sensitivity will be important in remotely located areas where communications reception normally is poor, according to the maker. The unit is designed for use in buildings or outdoors.

Its greatest usage will be in locations inaccessible to radio-equipped vehicles. Large industrial-type batteries power the radio. Modular construction is employed in the transmitter, making it easy to remove various stages for replacement if necessary.

All tuning points and components are readily accessible. **Write or call: General Electric Co., Communication Products Dept., Electronics Park, Syracuse, N. Y., for details on portable transmitter-receiver.**

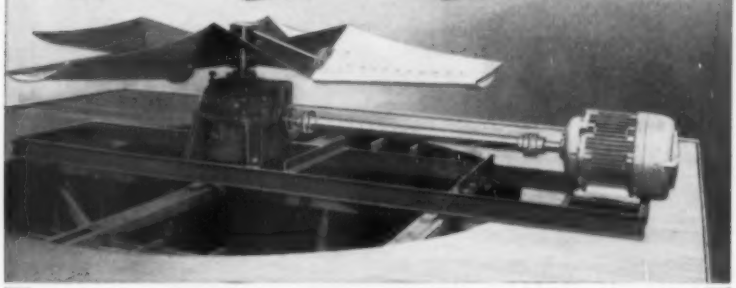
●

Protect Your Machinery with

THOMAS FLEXIBLE COUPLINGS

All Metal

NO LUBRICATION · NO MAINTENANCE · NO WEARING PARTS



COOLING TOWER INSTALLATION

In the typical cooling tower installation shown above, the motor — outside the humid or corrosive atmosphere — is connected by a floating-shaft coupling to the gear box under the large slow-speed, horizontal-blade fan.

REFINERS! PIPE LINE MEN! DRILLING ENGINEERS! LABORATORY TECHNICIANS!

Thomas Couplings are used to advantage on Pumps, Compressors, Cooling Towers, Rigs or any other tough job where continuous operation and dependability are required.

Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings.

Under Load and Misalignment only Thomas Flexible Couplings offer all these advantages:

1 Freedom from Backlash Torsional Rigidity
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5 Original Balance for Life
6 No Lubrication
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8 No Maintenance

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

Write for Engineering Catalog 51A

THOMAS

THOMAS FLEXIBLE COUPLING COMPANY

WARREN, PENNSYLVANIA, U.S.A.

Automatic engine starter for pumps

. . . overcomes need to run oil-well pumps continuously. Called Aut-O-Start, it will: (1) energize the starter solenoid, (2) open the fuel valve, (3) disconnect the magneto ground until the engine starts, (4) close the clutch power-unit control valve, (5) run the engine until it reaches operating temperature, (6) engage the clutch, (7) operate the engine for a set time, (8) stop the engine, (9) disengage the clutch, and (10) recycle itself a set number of hours later.

Clutch power unit, which engages the clutch, is completely controlled by the engine. No jerking or sudden strain is imposed on the pumping equipment.

If the engine stops during the pumping cycle, the fuel valve automatically closes. The device uses the same battery that energizes the engine starter. No outside power is needed. Thus the equipment can be used in remote places. It can be set to run any number of hours on or off. List price is $297. **Write or call: Fluid Control Co., 26 East Eighteenth Street, Chicago 16, for details on Aut-O-Start.**

SHOWCASE . . .

New Literature

Polyvinyl chloride lining

. . . for corrosion protection is detailed in new 12-page Manual LC-58. Individual characteristics of conventional flexible lining, special nontoxic, white P-V-C flexible lining, and unplasticized P-V-C lining—called Fligid are detailed. A table compares conventional and unplasticized linings in terms of their resistance to acids, alkalies, salts, organic compounds, and miscellaneous liquids. **Write or call: Kaykor Industries, Inc., Div. of Kaye-Tex Mfg. Corp., Yardville, N. J., for Manual LC-58.**

Pressure regulators

. . . and how to select them are reviewed in new 28-page Bulletin 401. It details considerations for correct application of self-operating and pilot type of pressure regulators. The handy bulletin covers back-pressure and relief valves of spring-loaded and weight-loaded types; reducing valves; and remote pilot-type and valve-mounted regulators. Pump governors, and steam-operated, packless, self-contained regulators are also covered. **Write or call: Kieley & Mueller, Inc., 64 Genung Street, Middleton, N. Y., for Bulletin No. 401.**

Rubber Catalog 575

. . . is a new six-page, two-color bulletin giving complete information on rubber expansion joints and flexible pipe. They are available in three styles: (1) Style 1000 for vacuum operation, (2) Style 1025 for pressure operation; and (3) Style 1050 for vacuum and pressure operation. The expansion joints and flexible pipe are available in sizes from ½ to 72 in. i.d. **Write or call: General Rubber Corp., Summit and Atwood Streets, Tenafly, N. J., for Bulletin 575.**

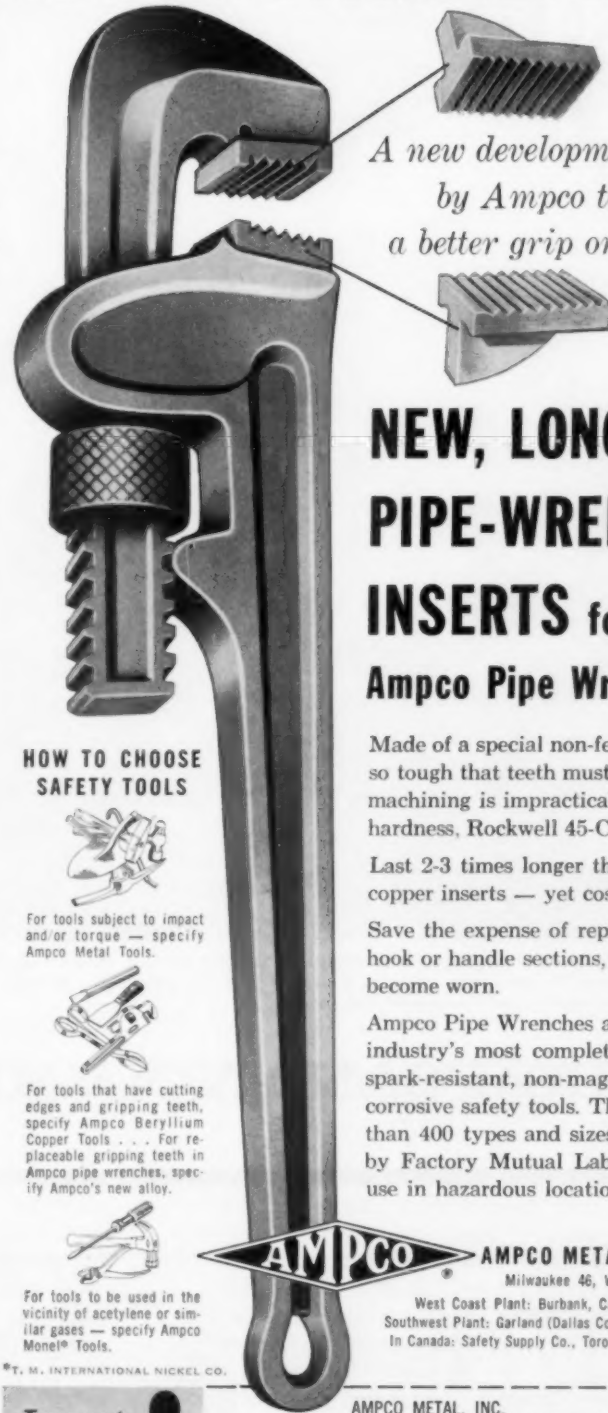
Flexible couplings

. . . are detailed in new four-page Bulletin 56. Products include gear couplings flexible couplings, and a new nylon gear coupling which needs no lubrication. Also detailed are a cutout and cutout coupling. Charts describe each size and model. **Write or call: John Waldron Corp., New Brunswick, N. J., for Bulletin 56.**

Automatic alarm and control

. . . systems, called Monitron I and II, are described in a new four-page bulletin. The system gathers alarm and control data from remote stations. It

AMPCO PIPE WRENCHES MEET U. S. GOVERNMENT HEAVY-DUTY REQUIREMENTS



A new development by Ampco to give you a better grip on safety!

NEW, LONG-LIFE PIPE-WRENCH INSERTS for all Ampco Pipe Wrenches

Made of a special non-ferrous alloy so tough that teeth must be cast in — machining is impractical. Minimum hardness, Rockwell 45-C.

Last 2-3 times longer than beryllium copper inserts — yet cost no more!

Save the expense of replacing entire hook or handle sections, when jaws become worn.

Ampco Pipe Wrenches are part of the industry's most complete line of spark-resistant, non-magnetic, non-corrosive safety tools. There are more than 400 types and sizes approved by Factory Mutual Laboratories for use in hazardous locations.

HOW TO CHOOSE SAFETY TOOLS

For tools subject to impact and/or torque — specify Ampco Metal Tools.

For tools that have cutting edges and gripping teeth, specify Ampco Beryllium Copper Tools . . . For replaceable gripping teeth in Ampco pipe wrenches, specify Ampco's new alloy.

For tools to be used in the vicinity of acetylene or similar gases — specify Ampco Monel® Tools.

®T. M. INTERNATIONAL NICKEL CO.

AMPCO METAL, INC.
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T-31

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Send me Catalog ST-10; also further facts on the new pipe-wrench inserts.

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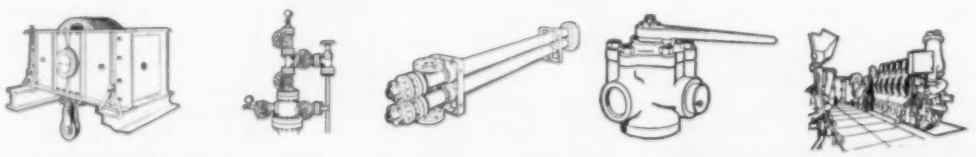
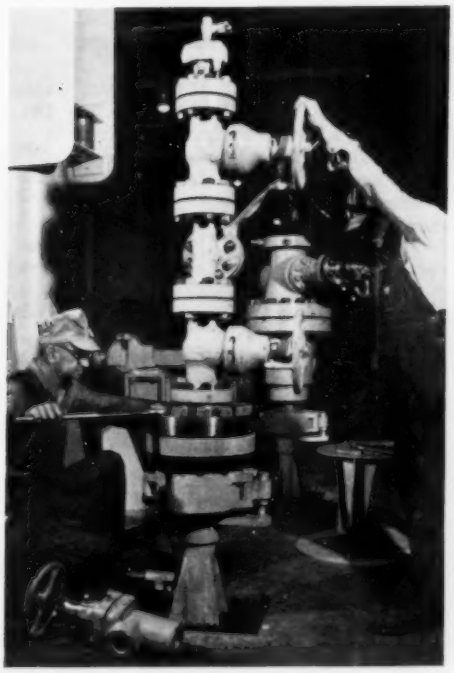
Ready to fracture a West Texas Wildcat. 15,000 gallons of oil and 22,500 lb. of sand are being put through this ALCO non-lubricated gate valve at a rate of 11.6 bbl/minute and at 5400 psi. ALCO valves stand up against abrasion, corrosion, and neglect wherever they are.

HIGH SAND VOLUME FRAC JOBS



Crown and travelling blocks • Wellhead equipment • Finned tube products • Kinney plug injectors • Diesel-electric power package

Every ALCO non-lubricated gate valve has both gate and seats faced with hard, stainless, non-galling alloy to resist corrosion and erosion.



Test racks at Odessa and Beaumont mean that your tree has been proved more than safe before shipment.

PROVE ALCO VALVES CAN TAKE IT

Frac jobs in West Texas can often mean high injection rates, high volume of oil and, especially, high sand volume. Controlling fracturing is no job for the ordinary Christmas Tree valve. But ALCO non-lubricated gate valves stand this tough service and cost this operator less than any other valve *including mud valves.*

The sand conditions on your well may not be equal to those in a frac job, but with ALCO you know your valve will beat the worst conditions of sand and pressure.

This gate valve costs you less in upkeep, too. It's non-lubricated, always ready at a moment's notice to be opened or closed. It closes tight with a stainless metal-to-metal seal which won't fail.

The proved ALCO non-lubricated gate valve is part of the complete ALCO tree: casing heads, tubing heads, valves, flow controls. ALCO stocks are in Odessa, Wichita Falls, and Beaumont now. For a test on your worst well, write ALCO Products, Inc., Department 186, Bank of the Southwest Building, Houston 2, Texas.

ALCO

ALCO PRODUCTS, INC.
Petroleum Industry Equipment Division
HOUSTON

transmits the data to a central station over wire or radio for visual and aural presentation. It can be used to scan and telemeter such physical quantities as velocity, flow, temperature, pressure, and resistance. **Write or call: Moore Associates, 2800 Spring Street, Redwood City, Calif., for Monitron I and II Technical Bulletin.**

Price list for logging

. . . perforating, fracturing, and acidizing services of Western Co. are detailed in a new comprehensive folder. General terms and conditions are specified as well as the code series. Price lists are included for radioactivity logging, jet perforating, special wire-line services, acidizing, fracturing, and special pumping services. **Write or call: Western Co., Box 310, Midland, Tex., for engineered well services prices.**

High-injection-rate fracturing

. . . for better results and faster payout is reviewed in a new four-page technical bulletin. The bulletin presents the results of an independent study of 199 wells. The study showed a 523% increase in production using the company's high-injection-rate fracturing. Reports for another pool are also reviewed. **Write or call: Dowell Incorporated, P. O. Box 536, Tulsa 1, for high-injection-rate fracturing bulletin.**

Oxygen analyzer

. . . on a catalytic cracker of a major oil refinery is discussed in new two-page Application Data Sheet 0-42001. A description of the installation together with illustrations and a flow diagram present details on the analyzer which has been in continuous operation since October 1954. The analyzer monitors the oxygen in flue gas from the regenerator. **Write or call: Beckman Process Instrument Div., 2500 Fullerton Road, Fullerton, Calif., for Data Sheet 0-42001.**

Couplers and fittings

. . . and aluminum-clad pipe for oil, gas, and water lines are described in two new bulletins. The Line-Lok couplers are all aluminum and flow free with no obstructions. They feature die-cast threads for easy operation and Neoprene gaskets. Tees, elbows, adapters, and end plugs of heavy-wall aluminum are described in one bulletin. The other bulletin dealing with aluminum-clad petroleum pipe stresses the pipe's lightweight and ease of portability and installation. A chart shows specifications. **Write or call: Warren Mfg. Co., Riverdale, N. J., for petroleum pipe bulletin and Line-Lok couplers and fittings bulletin.**

Pilot-operated valve

. . . reduces vapor losses and increases profits according to new six-page Bulletin 581. The bulletin describes Oceco valves for cone-roof and other low-pressure tanks that reduce tank breathing to the minimum and increase product savings. Valves pay for themselves in 7 to 8 months through vapor savings, the bulletin reports. **Write or call: Johnston & Jennings Co., 6917 Bessemer Avenue, Cleveland 27, for Bulletin 581.**

Crude-oil conditioner

. . . for removing the causes of fouling and corrosion in refineries is described in a new 10-page bulletin. The product is Cronox C conditioner. It's a concentrated, liquid, oil-treating chemical. It is blended with water and soda ash. The bulletin tells how the chemical provides protection by removing oxygen and neutralizing acids. It presents three refinery case histories showing how condenser replacement and frequency of turnarounds were decreased. **Write or call: Aquaness Dept., Atlas Powder Co., 2005 Quitman Street, Houston 26, for bulletin on Cronox C.**

An index of instrumentation products

. . . by Midwestern Instruments and a 20-page booklet on the company's new plant facilities are now available. The instrument index includes oscillographs, galvanometers, magnetic tape recorders, magnetic recording and reproducing heads, bridge balance units, amplifiers, power supplies, current sources, data repeaters, servovalves, torque motors, and precision analog recording systems. The booklet on the plant is a pictorial presentation of the company's organization and manufacturing procedures. **Write or call: Midwestern Instruments, Forty-first and Sheridan, Tulsa, for instrument index and plant facilities booklets.**

Complete product-line price list

. . . now in effect is offered by B&W Inc., specialists in primary-cementing tools. Reductions are offered in scratchers and centralizers. And stop collars and friction-lock clamps are reduced when ordered with the company's cementing tools. **Write or call: B&W Inc., Box 5266, Houston 12, for price list.**

IT'S AS SIMPLE AS THIS..

No other valve Performs

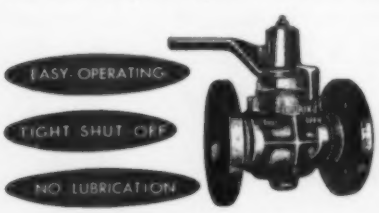
Like a DeZurik Valve

because

No other valve is made

Like a DeZurik Valve!

Exclusive eccentric action and resilient-faced plugs give tight shut-off and easy operation without lubrication! DeZurik Valves excel on so many services: salt water disposals systems, vacuum trucks, lube grease racks and many more.



In a complete range of models and metals and in sizes from ½" thru 20". Representatives in all principal cities, or write

DeZURIK CORPORATION
SARTELL, MINNESOTA

Demco establishes warehouse facilities

JIM ALLEN

. . . at New Iberia, La. Drilling Equipment Manufacturing Co. has also reorganized sales territories in the southern region to gain peak efficiency from the new supply point.

Crenshaw Sales Co., representing Demco in South Louisiana and South Texas, has released South Louisiana and will concentrate its efforts in the Texas territory.

Jim Allen has been transferred from Wichita Falls, Tex., where he represented Demco in the North Texas region, to Harvey, La., as district manager for South Louisiana.

Dick Ferrell transfers from the Oklahoma City office to New Iberia to be in charge of the warehouse and to assist Allen in giving service and representation in that area. Frank George, formerly with Great Bend Fishing Tool Co., has accepted the post vacated by Allen and will represent Demco in North Texas.

W-K-M appoints Robert D. Butler

R. D. BUTLER

. . . to the position of assistant to sales manager, plug valves. The announcement was made by B. J. Cross, vice president, marketing, of the division of ACF Industries, Inc. Butler joined the company in 1953 as sales representative, plug valves, in the southeastern part of the United States. He will locate in Houston in his new assignment and will report to W. A. Gormley, sales manager, plug valves.

Motor truck technical training center opened

. . . in Dallas, Tex., by the motor truck division of International Harvester Co., according to L. W. Pierson, manager of sales.

It will serve nearly 900 International truck dealers in Texas, New Mexico, Louisiana, Arkansas, Missouri, Illinois, Kansas, and Oklahoma.

Dealer servicemen who complete the training period of 1 week will be fully informed on proper service techniques and methods for units of the newest design. The new training unit will operate under the direction of W. A. Riggs, manager of the Southwest region. It is designed to be the best equipped service training facility in the industry. Classes of 20 servicemen per week can be accommodated by the center.

The Cooper-Bessemer Corp. boosts D. L. Gallogly

D. L. GALLOGLY

. . . to the position of chief engineer, reports Ralph L. Boyer, vice president and director of engineering. In his new capacity, Gallogly assumes responsibility for the supervision of all engineering divisions, under the immediate direction of Boyer.

Gallogly entered the service of Cooper-Bessemer in 1929. He has been service manager, chief engineer of the products division, and assistant executive engineer. Reporting directly to him will be: T. O. Kuivinen, chief engineer, technical division; R. F. Kymer, chief engineer, products division; and W. R. Crooks, chief engineer, development division. Gallogly succeeds E. Frederick, who has retired.

W. M. Krum, Sam D. Rogers, and John R. Monkhouse examine a modern section plotter as . .

Rogers Geophysical Co. doubles plant facilities

The completed program at Houston headquarters of the company allows increased space for administration and laboratory and equipment assembly. The new wing contains executive offices, a conference room, seven instrument research rooms, secretarial area, tripled drafting room facilities, a printing and a mechanical room, a coffee bar, and a storage vault.

All electronic equipment for the field operation of Rogers crews is assembled in Houston. In addition, central playback and record plotter facilities are located in the plant with other such equipment located in Caracas and Paris.

Rogers maintains supply depots in Houston; Maracaibo; Galkaino, Somaliland; Sahara, Algeria; Paris; Gallcaio, Somaliland; and Las Anod, British Somaliland. Affiliate companies are Rogers Geophysical Co., Ltd., London; Geofisica Geophysique, Paris; and Rogers Sahara Compane, Algeria.

This is the second expansion since the company's founding in 1951 by Sam D. Rogers. The first expansion was in 1952. This second expansion adds 12,750 sq. ft. to the plant.

Stuart Steel appoints W. C. Smith, J. J. Smith

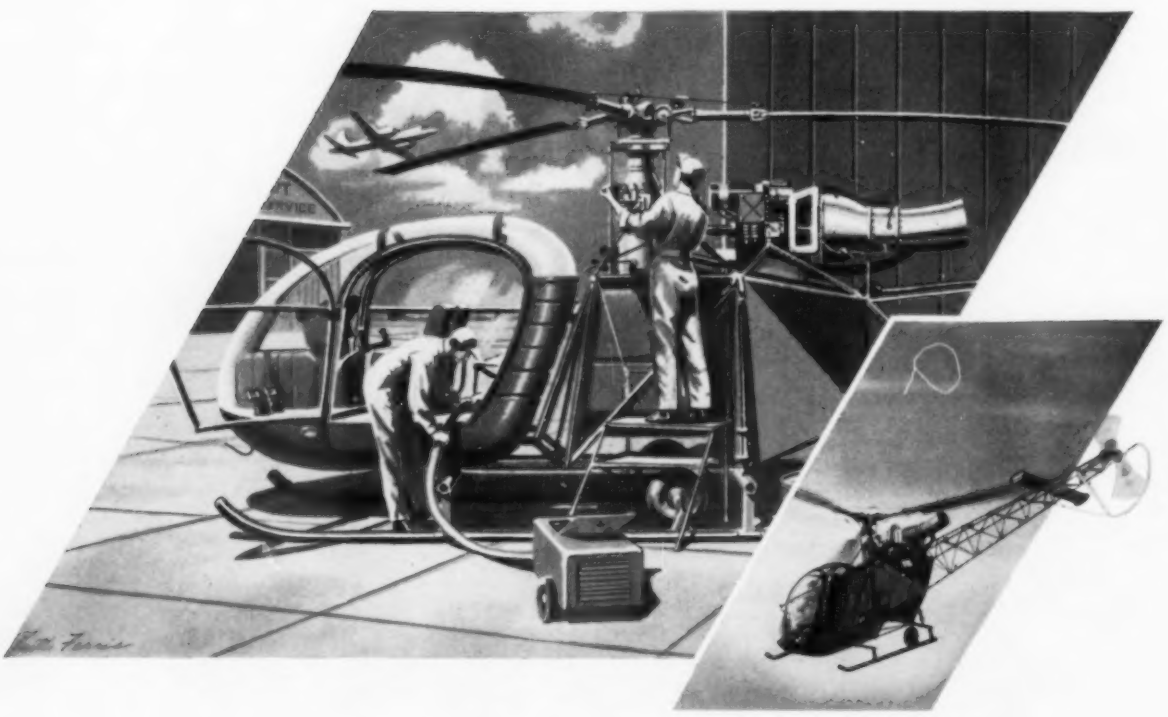
. . . southeastern district manager and sales representative, respectively, according to Linden Stuart, Jr., president of Stuart Steel Protection Corp.

W. C. Smith will maintain offices in Atlanta, Ga., and will be responsible for the sales of pipeline corrosion prevention materials in that area. He was formerly sales representative in New York State and New England.

J. J. Smith will work out of the main office in Plainfield, N. J., and

ALOUETTE ECONOMY

FOR COMMERCIAL TRANSPORT



Management in all types of commercial flight must give slide-rule thought to operational costs. The outstanding economy record of the Alouette, world's first production turbine-powered helicopter, is less than one hour maintenance for each hour of flight . . . pre-flight, preventive and corrective time. ➢ ➢ This pattern emphasizes the Alouette's operational economy compared with up to five hours maintenance for each hour of flight for competitive, commercially operated helicopters. By no means incidental is the sizable saving in the unusually low fuel costs. ➢ ➢ Republic Aviation Corporation with more than a quarter-century of advanced concept in aircraft manufacturing, assembles, tests and assures in the new Alouette . . . "Tomorrow's design . . . today!"*

**Designed by Sud Aviation of France*

- *Instant take-off . . .*
- *Simplified controls*
- *Instantaneous power response*
- *Low maintenance time to flight time*
- *Top performance in extreme hot or cold weather*

CONTACT HELICOPTER DIVISION FOR LITERATURE AND DEMONSTRATION — EARLY DELIVERY.

REPUBLIC AVIATION CORPORATION

HELICOPTER DIVISION

FARMINGDALE, LONG ISLAND, N. Y.

will be responsible for the sales of pipeline corrosion prevention materials in New York State and New England. He replaces W. C. Smith, and has been with Stuart for 7 years in various capacities.

Schlumberger Well Surveying Corp. elects

. . . Ame Vennema, vice president, personnel relations, as vice president, administration, and chief of staff of Schlumberger, Ltd.

AME VENNEMA

He joined the corporation as a field engineer in 1937. He transferred in 1948 to Houston headquarters where he directed the organization of the personnel relations department. He became vice president in 1951.

Replacing Vennema as head of personnel administration is Gordon D. Watson, who has been appointed director of personnel relations. He has served as Vennema's assistant since he joined the corporation in 1950. He served with Pan American Petroleum Corp. before joining Schlumberger.

McCullough Tool Co. reports personnel changes

. . . in its eastern division sales department, according to O. J. McCullough, vice president.

Those recently promoted to the position of sales representative are: Billy F. Davis, Natchez, Miss.; J. C. Warren, Magnolia, Ark.; James E. Hampton, Pampa, Tex.; and D. B. Berry, Shreveport, La.

Sales representatives recently transferred include: A. D. Wilson, formerly at Odessa, Tex., to the Victoria, Tex., branch office; and Bobby L. Martin, formerly at Cortez, Colo., to Odessa, replacing Wilson.

L. D. Uhler appointed sales representative

. . . for Sperry Western, Inc., and will cover the Texas Gulf Coast area from the main office in Houston, according to Clinton R. Hilliker, operating manager.

Uhler was for 2 years a sales engineer with Union Tank division of Butler Manufacturing Co., and Parkersburg Rig & Reel Co. He was also an independent consulting engineer in Corpus Christi, Tex. He has also served as a reservoir engineer for 4 years for Gulf Oil Corp.

Sperry Western, Inc., is a subsidiary of Sperry Products, Inc.

Beech Aircraft Corp. promotes A. L. Clark

. . . to manager of engineering and sales of its Boulder division in Boulder, Colo., reports Frank E. Hedrick, vice president-director.

In his new position, Clark will assist G. W. Hostettler, newly appointed manager of the Boulder division. He will be responsible for all engineering and sales activities in connection with division operations.

Clark has served as chief project engineer on external stores and research at Beech's home office in Wichita, Kans. He joined Beech as a draftsman in 1940 and advanced to assistant chief project engineer, chief of power plants, project engineer, and chief project engineer.

Dr. Bernard M. Sturgis named secretary

. . . of the Division of Petroleum Chemistry of the American Chemical Society. He succeeds W. G. Lovell of the Ethyl Corp.

Sturgis is a director of E. I. du Pont de Nemours & Co., Inc.'s petroleum laboratory. He joined Du Pont in 1936 as a research chemist in the rubber chemicals field and 10 years later

Watch . . .

WILLIAMS BROTHERS

New York
Washington — Pittsburgh — Louisville
Minneapolis — New Orleans — Caracas
Bogota — La Paz — Edmonton
Calgary — London — Ankara — Tehran

ENGINEERS-CONSTRUCTORS
NBT BUILDING TULSA, OKLAHOMA
CABLE ADDRESS: WILLBROS

became head of the petroleum chemicals division at the Jackson laboratory. He was assigned to its petroleum laboratory in 1951 and was named director in 1956.

Rolo Manufacturing Co. elects Walter Lee Henry

W. L. HENRY

. . . vice president, manufacturing. He was with Continental Can Co. for 21 years before joining Rolo. While with Continental, he served as superintendent of production at the Chicago plant and as assistant plant manager at the Houston plant.

He has been with Rolo for 2½ years and was plant manager until his recent promotion.

Val Joe Walker named sales representative

. . . in the southwestern area for Walker-McDonald Enterprises of Dallas, representing W-M Bit Co., W-M Manufacturing Co., and Gold Digger Bit Co. He had been engaged in selling work in the Dallas area before joining Walker-McDonald.

Walker-McDonald Enterprises, owned by L. M. Walker and R. E. McDonald, manufacture 2-and 3-cone rotary rock bits, finger bits, and Gold Digger insert bits.

American Marine, Inc., delivers Russell B.

. . . to Work-Over, Inc., of Houston. The barge, designed for both drilling and workover, is 165 ft. long and 46 ft. wide. The derrick floor is 22 ft. above the barge deck. The high substructure permits the use of maximum blowout preventer equipment. Prime power for draw works and mud pumps is supplied by Caterpillar units. The draw works is a Continental-Emsco GB-500. The drilling mast is a Continental-Emsco B-134 portable mast, designed for front leg pivot for barge applications. Pumps are Gardner-Denver and Wilson-Snyder.

Burgess-Manning Co. elects new officers

S. G. Paddock, elected to executive vice president 1 year ago, was elevated to the presidency to replace R. L. Leadbetter. Leadbetter has retired from the office of president, but will continue to be associated with the company in a consulting capacity and as a director.

H. A. Dietrich was promoted to vice president, in charge of the Industrial Silencer Division, with offices at Libertyville, Ill., and Dallas, Tex. He will headquarter at the Libertyville plant where he has served as general manager for 3 years.

Paddock joined the company in October 1936, in a sales capacity. He later played an important role in establishing the company's pulsation snubber operation in Dallas. He is expected to leave shortly for Europe to review the company's British interests, going to several other countries on the continent.

Dietrich joined Thordarson Electric Co. in 1935, which became a part of the Burgess-Manning organization in 1937. He has served in engineering, field service engineering, and sales.

Baash-Ross Division names Terrell and Lindgren

. . . as chief engineer at Houston and West Coast operations manager at Long Beach, Calif., respectively, according to Glenn D. Johnson, general manager.

B. J. TERRELL

E. R. LINDGREN

B. J. Terrell will be in charge of the engineering departments of the Houston and Long Beach plants. He will supervise product design and the new product research and development program. He joined Baash-Ross in June 1957. He has served with Luftex Machine Products Co. and Western Co.

E. R. Lindgren joined Baash-Ross in 1929 as an engineer. Since that time he has also served as assistant chief engineer and chief engineer.

Houston Nomads hear Dr. Corey Croneis

. . . . share his knowledge of the oil installation and oil possibilities of the Amazon River basin. Croneis is provost of Rice Institute and head of the geology department. President Ed Louden, Baroid Division, presided at the meeting and Tom Nelson, Gulf Publishing Co., introduced the speaker.

International guests at the meeting were, front row: Jacques Brisac, Cie Francaise des Petroles, d'Algerie; Norbert E. Rieter, Jr., Reed Roller Bit Co., Libya; and James Bayliss, Manufacturers Representative, Brisbane, Australia. Back row: Lucien Taneux, Cie Francaise des Petroles, d'Algerie; Frank Allinson, Cie Francaise des Petroles, d'Algerie; Claude Barberot, S. N. Marep, Paris; Raymond Parre, S. N. Marep, Paris; and Martin Mears, Tidewater Oil Co., foreign operations, San Francisco.

Owens-Corning Fiberglas Corp. buys Kaylo Division

. . . of Owens-Illinois Glass Co., Harold Boeschenstein, Owens-Corning president has announced.

The acquisition includes the manufacturing plant at Berlin, N. J., where

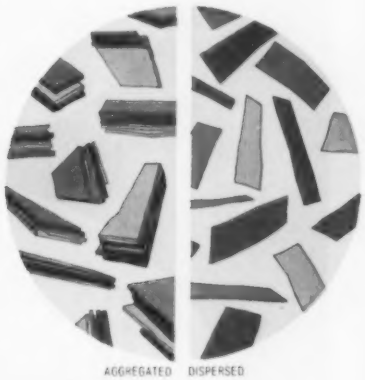
Seeing is believing . . .

Q-BROXIN*

controls flow properties *in drilling mud*

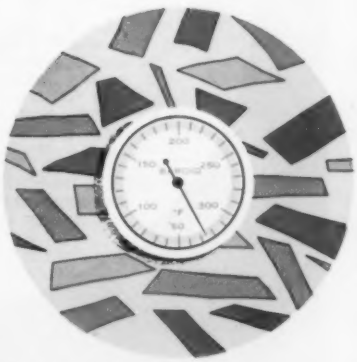
RESISTS ANHYDRITE CONTAMINATION

OVERCOMES EFFECTS OF SALT WATER



KEEPS MUD DEFLOCCULATED

Q-BROXIN'S effectiveness in reducing viscosity and gels in salt, gyp or fresh water mud is unique among mud thinners. This unique property has led to widespread use of **Q-BROXIN** for compounding aggregated muds with a filtrate that inhibits the swelling of clays and shales. In these and other types of mud **Q-BROXIN** has a surprising capacity to reduce filtration. You can hold down mud drilling costs when you specify **Q-BROXIN** —*and* Baroid know-how.



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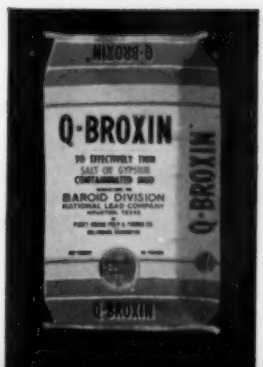
B-5810



FOR FAST PUMPING

BUT EASY ON THE RODS

The H-F 3-Tube Rod Pump consists of two concentric, loose-fitting tubes (plunger and jacket tube) that telescope over and in a third, stationary tube which serves as the pump barrel. In operation, fluid is circulated in the annular space between the outer tube and the standing barrel which packs off and compensates for the loose plunger fit. This "fluid seal" design allows the plunger to fall freely so that the pump can be operated at the optimum pumping rate — even if a fast rate is desired — and yet be easy on the rods. The loose-fitting plunger and small plunger bore afford a number of other operating advantages, such as a higher fluid discharge velocity, keeping float sand in suspension, reducing failures due to excessive rod stretch, reducing plunger friction and abnormal wear of working parts, and preventing the plunger from sticking or galling due to sand or abrasion in the fluid. H-F 3-Tube Rod Pumps, with standard A.P.I. balls and seats, are available in 2" x 1¼", 2½" x 1¾", and 4" x 3¼", sizes in 12' to 25' lengths from leading stores throughout the oil patch. Either regular or on-and-off types can be furnished. Ask your store, or one of our representatives, for illustrated literature, or write P. O. Box 127, Fort Worth.

H-F 3 TUBE ROD PUMP

HARBISON-FISCHER

2501 VIRGINIA STREET • FORT WORTH

"Best Pumps in the Oil Patch"

Kaylo is produced. Kaylo, an industrial heat insulation product, block and pipe products have been distributed nationally since 1953 by Owens-Corning to supplement its own line of Fiberglas industrial insulations. These products are used in the power, chemical, refining, and other process industries.

G. Turner Armstrong named vice president and manager

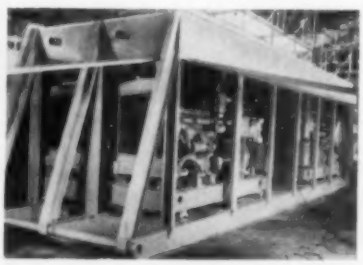
. . . of research and development for Welex, Inc., at Houston.

He moved to the Houston position after serving as vice president and division manager of the company's North Texas-Panhandle division, headquartered in Dallas.

De Laval Separator Co. elects W. A. Neumann, Jr.

. . . president. At the same time, he was elected president of De Laval's West Coast subsidiary, De Laval Pacific Co. C. B. Schmidt, whom Neumann succeeded, has been named vice chairman of the board of directors.

Neumann joined De Laval Separator as executive vice president, manufacturing, in 1954. Previously he was vice president, industrial sales, of De Laval Steam Turbine Co. Prior to that, he was with Westinghouse Electric Corp.



Two British engine firms show unitized packages

. . . at the Chemical and Petroleum Engineering Exhibition being held in London this spring. Leyland Motors, Ltd., in conjunction with Auto Diesels, Ltd., is exhibiting a range of equipment for use on drilling and exploration rigs.

The two firms are featuring this utility power house incorporating Leyland/Auto Diesels diesel generators, along with individual generating equipment for auxiliary applications. The unit shown combines three alternator sets, each rated at 90 kva. Superstructure carries a 1,500 imperial gallon fuel tank, automatically refueled by a fuel transfer pump from the bulk supply.

Parkersburg Rig & Reel Co. names Smith, Armstrong

. . . according to W. J. Slaughter, division manager. Samuel S. Smith has been named regional sales manager of the newly-activated Rocky Mountain sales region for the pumping unit division, headquartering at Denver.

S. S. SMITH

R. ARMSTRONG

Ray Armstrong, who was transferred from the Fort Worth office, will replace Smith in the Canadian division and will be in charge of pumping unit sales.

The Rocky Mountain sales region consists of the Rocky Mountain district and the Canadian district.

Cardwell Manufacturing Co. appoints J. S. George

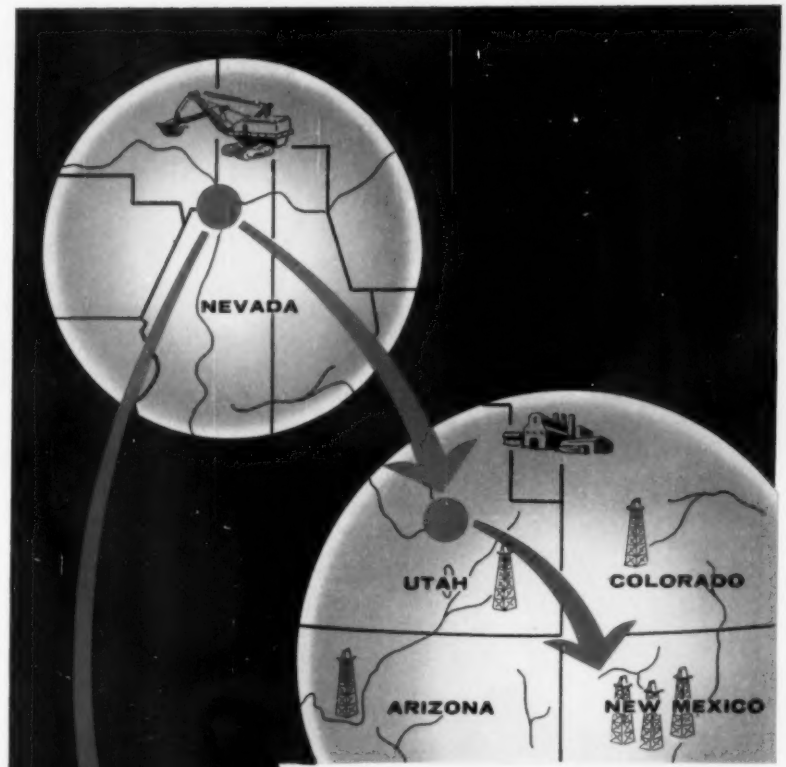
. . . as a special representative as part of its program to expand its equipment and oil-field supply operations in all company-operated stores. It was also announced that all Cardwell supply stores in oil fields have been reorganized and their activity expanded to carry complete stocks of supplies, including tubular goods.

George will work closely with all major oil company and contractors' offices in the Oklahoma area on tubular, supply, and machinery programs. He will headquarter in Tulsa.

Prior to joining Cardwell, he was with Summitt Drilling Co. in Tulsa. He has also been with Hughes Tool Co. and was president of Trans-Era Drilling Co. for 5 years.

Oil Field Drill Division is being consolidated

. . . with two of Joy Manufacturing Co.'s other divisions. The manufacturing operations and the marketing of rotary blast hole, and water well drill products, are being combined with Joy's Mining and Construction Division. The Michigan City, Ind., plant of this division has been producing similar drills for some time and



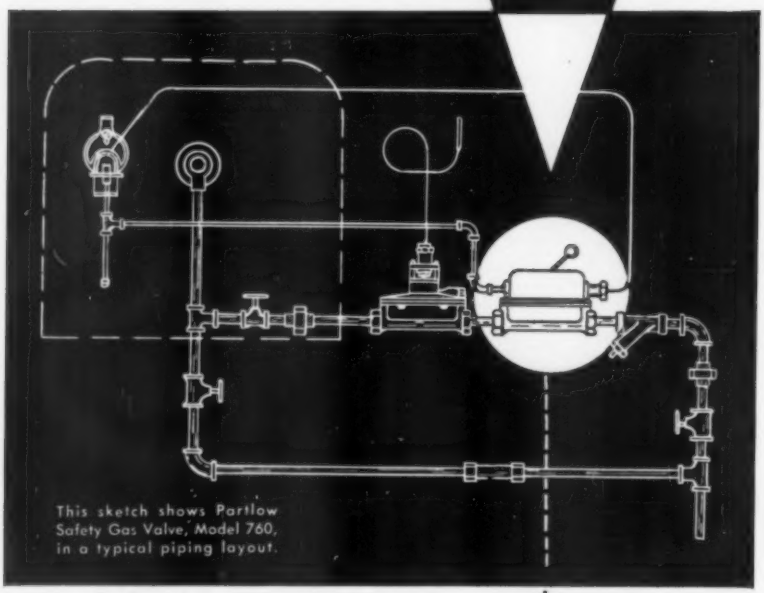
why YUBA BARITE'S high specific gravity pays off in performance and service!

From the Yuba Barite mines in Nevada comes an ore with a specific gravity of 4.2 or better—the natural property that makes Yuba Barite the ideal choice in any drilling operation where a maximum weight mud is essential. And because Yuba Barite requires no beneficiation, there's one less step from mine to mud pit . . . one more reason why toolpushers from the Four Corners to the Pacific Coast rely on speedy Yuba Barite service.

Strategically located mills in Salt Lake City, Utah, in Fresno and Emeryville, California assure a dependable source of supply. And Yuba Distributors, through their experience, can help you with your specific mud problems.

YUBA MILLING DIVISION
METALS DISINTEGRATING COMPANY, INC.
General Offices, Dept. B, Elizabeth B, N. J.
Salt Lake City, Utah • Emeryville, California • Fresno, California

Here's **positive protection** against gas pilot failure



This sketch shows Partlow Safety Gas Valve, Model 760, in a typical piping layout.

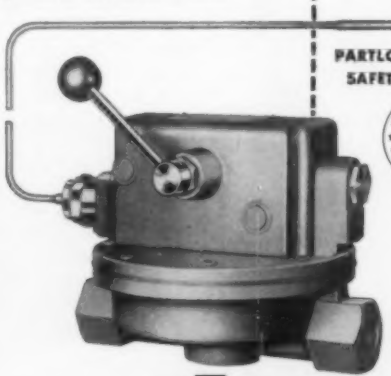
The Partlow Safety Gas Valve is ideally suited to oil field applications. *It's thermally operated . . . requires no electrical connections.*

This combustion safeguard gives positive protection to gas-fired appliances . . . prevents damage from gas pilot failure.

Rugged valve opens only after mercury actuated element becomes red hot from contact with pilot flame. If pilot goes out, element cools and releases a latch, causing valve to snap shut.

No conventional slip stem to corrode and stick. Strong perforated diaphragm guides valve disc to its seat.

PARTLOW MODEL 760 SAFETY GAS VALVE



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partlow

the pioneer in mercury thermal controls

Offices in All Principal Cities

is well adapted to making these additional products.

The oil-field products will be handled through the company's Baash-Ross Division, headquartered in Houston.

Kellogg International Corp. elects Liebrecht

. . . as president. It is a subsidiary of The M. W. Kellogg Co. E. F. Liebrecht, who will continue as a vice president of M. W. Kellogg, will establish his office at Kellogg House, London. He was also elected president of Societe Kellogg and will be responsible for the direction of this Kellogg subsidiary's activities in France.

He has been a vice president and director of Kellogg International and a vice president of M. W. Kellogg since 1946.

Black, Sivalls & Bryson, Inc., names Ed Rhodes

ED RHODES

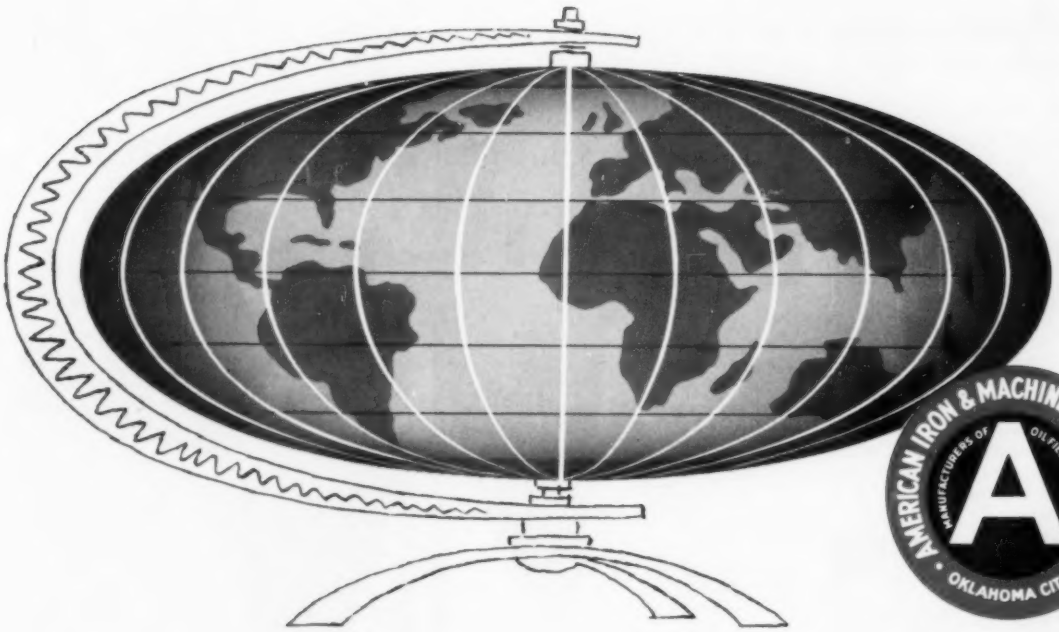
. . . as manager of its Farmington, N. M., oil field district, according to Floyd C. Myers, vice president and manager of oil-field equipment sales. Rhodes succeeds Joe Beggs, who has managed the Farmington district for the past year. Beggs will now devote full time to promotion and sale of dehydration and other process equipment in the Four Corners area.

Rhodes joined BS&B in 1947. He served as branch manager at Powell, Wyo., and district engineer at Casper, Wyo. Prior to his present assignment he was gas processing equipment staff specialist.

Servco transfers Marc Loy

. . . to Oklahoma City to take charge of all Oklahoma operations for the company. He was formerly sales manager of its Long Beach office. He has previously served as engineer with British-American Oil Co. and joined Servco 4 years ago.

Servco manufactures drilling and down-hole milling tools.



Wherever You Are . . .
There's "AMERICAN IRON"

If you are drilling for, or producing oil anywhere in the world . . . jungles, deserts, frozen lands or swamps, you'll find American Iron Sales and Service representatives ready to make available to you the complete line of American Iron Drilling and Production Equipment.

American Iron export agents know their products! They have been factory-trained on the manufacturing procedures . . . product design . . . and the latest methods of field operations of all American Iron export products.

More and more, oil producers throughout the world are relying on the superior performance and dependability of American Iron Drilling and Producing Equipment . . . and the experience of American Iron's export agents.

Next time you plan to order for export . . . . . .
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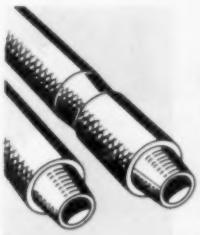

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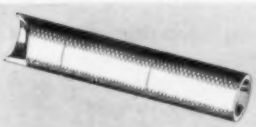

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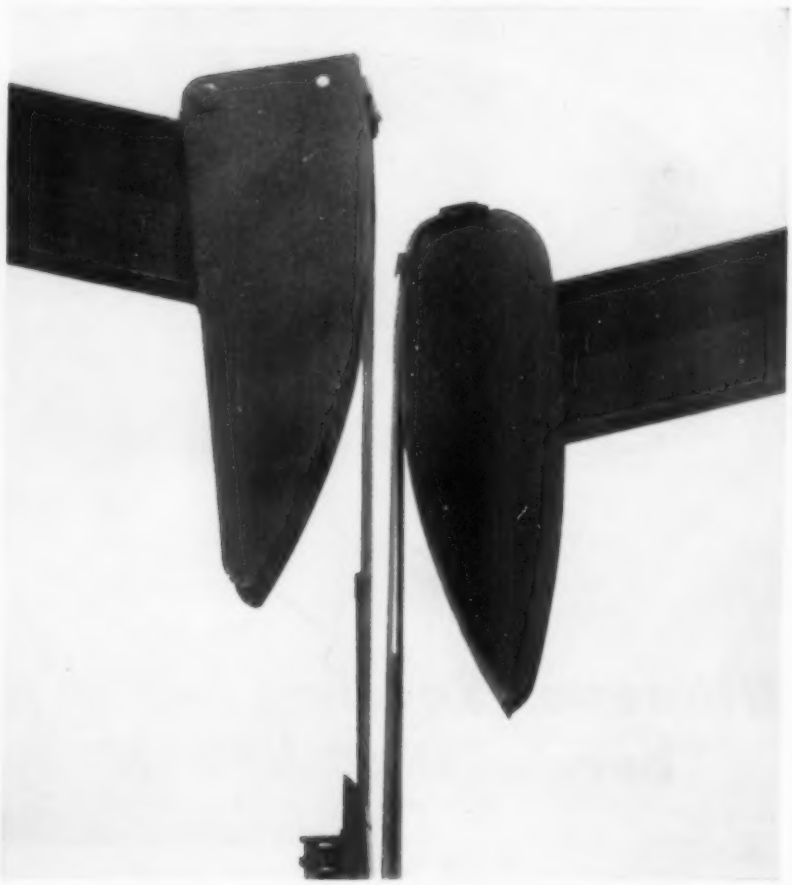

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How to get an overnight payout

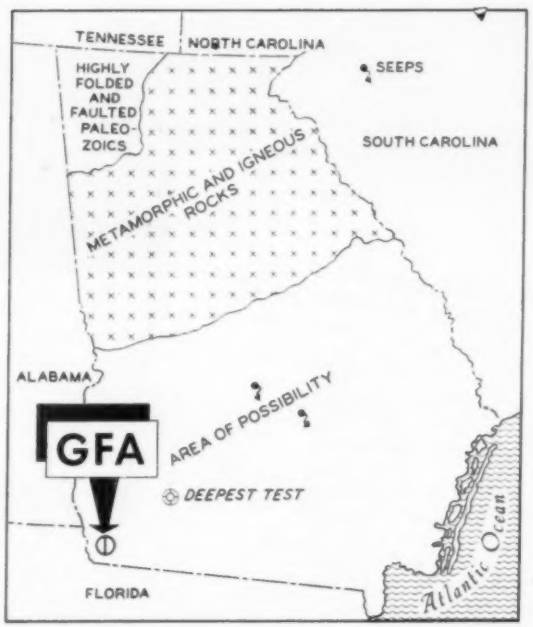
BY FRANK J. GARDNER

WANTED: one 100-bbl. oil well in the State of Georgia; reward $250,000. That's been a standing offer by the state since 1956, when a constitutional amendment authorizing the reward won approval by every county in the state. Prior to that, a $100,000 reward for a 250-bbl. well had gone unclaimed for many years. Evidently, the citizens of oil-hungry Georgia felt that a larger reward for a smaller well would entice more wildcatters into the state. If so, it's slow to show, for only two wells were sunk in 1957, and none so far this year.

The deepest hole . . . Now, however, comes the announcement of a new wildcat in southwestern Georgia's Seminole County with a target depth of 8,500 ft. If carried that deep, it would be the deepest hole ever drilled in the state. The drilling-depth record now is held by J. R. Sealy's 3 Seminole Naval Stores (also known as "3 Spindletop") a 1956 operation that still stands "suspended" at total depth 7,613 ft.; the rig is still there "stuck in the mud" according to one Georgian.

This new wildcat could tell a very interesting tale in more ways than one. If it should find oil, of course, it would make history. But wet or dry, it should provide some vital geological dope on the subsurface section in this, the most-likely-to-produce part of Georgia. It is being drilled by the G.F.A. Oil & Gas Corp. of Moultrie, Ga., and has dry-hole support from Humble Oil & Refining Co. Known as the 4 J. R. Sealy et al-Spindletop, it lies on Land Lot 214 in Land District 21 of Seminole County. Survey Drilling Co., of Dallas, holds the contract.

Has bad luck . . . It is to be hoped that the operators have better luck in later drilling than they've had so far. The wildcat was spudded on May 30; the big rotary rig made only 238 ft. before it hit a subsurface cavern and gave every indication of cratering. Fearing loss of the rig, contractor moved it off location. At the moment, the operators are bringing in a cable-tool outfit to get through the treacherous Eocene surface formations and set surface pipe. Then they hope to resume operations with rotary, possibly with air as the drilling medium.

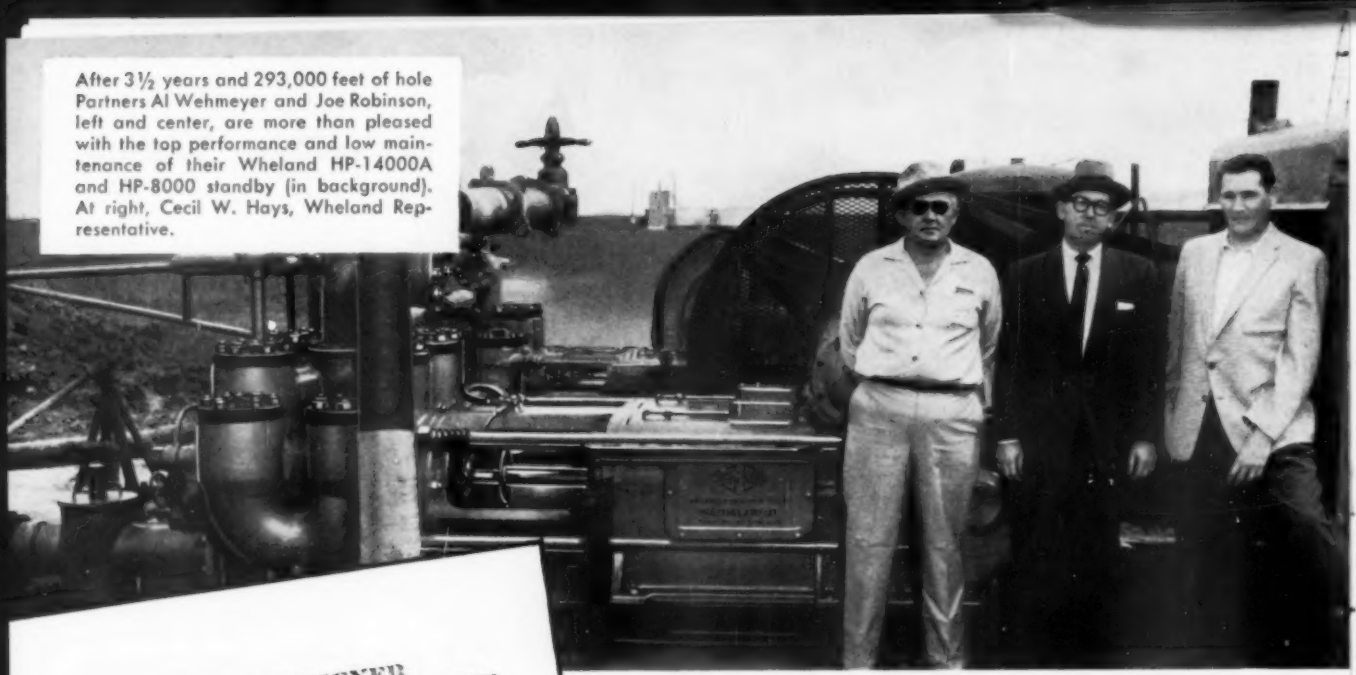


GEORGIA is the site of a new 8,500-ft. wildcat, deepest target depth ever announced for that state. G.F.A. Oil & Gas Corp. is drilling in Seminole County toward a Cotton Valley-Jurassic objective. A hit here would be worth $250,000 to the operator.

What do they expect to find? Geophysical surveys in this area are plagued by poor returns and the picture is not too good. But previous wells in the vicinity have given up some encouraging signs of a regional interruption of the characteristic southward dip in the Southwest Georgia basin. The log of Sealy's 3 Spindletop, located 3 miles north of his 2 Spindletop, ran level with that of the latter well. The 1 and 2 Spindletop found noncommercial methane gas. And the 3 Spindletop gave up a Cretaceous core that looked "mighty encouragin' " to Georgia geologists. "It strongly resembled the Olmos sand of South Texas," commented one.

But has six more chances . . . G.F.A. anticipates that at 8,500 ft., the wildcat should tap the Cotton Valley-Jurassic. Humble's dry-hole agreement calls for 8,500 ft. **or** 100 ft. into the Paleozoics. J. W. Hicks, president of G.F.A., expects to penetrate at least six possible pay sands, including the Eutaw and Tuscaloosa (Upper Cretaceous) and possibly four Trinity (Lower Cretaceous) formations before reaching Cotton Valley. There is a definite possibility of wedgeouts at the Cretaceous-Jurassic unconformity.

So wish the Georgians luck in their search for oil. About 100 wells have failed in the state so far, but few of them have gone deeper than 3,000 ft. and most have stopped at the 1,500-ft. level. This can hardly be called a fair test of the state's possibilities. But a few more deep ones like the G.F.A. wildcat may lead to a collection of the quarter-million-dollar reward. Question: what if it's a gas well? Or a condensate well?



After 3½ years and 293,000 feet of hole Partners Al Wehmeyer and Joe Robinson, left and center, are more than pleased with the top performance and low maintenance of their Wheland HP-14000A and HP-8000 standby (in background). At right, Cecil W. Hays, Wheland Representative.

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Are geologists earning their pay?

BY GALEN N. SHIRLEY

ARE GEOLOGY and geological methods being used to yield their maximum possible benefits to the oil industry?

In too many cases the answer is "No." To use geology to a greater extent, the structural basis of all scientific investigations must be better understood and applied. Most geologists are familiar with scientific methods to some degree but in many cases, the methods have not crystallized into a definite working plan.

Many problems are suspended where the real thinking should begin, believes the author, Galen N. Shirley. Since receiving his geology degree at Indiana University, the author has served as geologist for the Plymouth Oil Co. in the Rocky Mountain area.

In scientific fields, basic researchers probe the outer frontiers of knowledge in limited areas seeking out the fundamental relations from which new insights and concepts are formed. These ideas then are subjected to experimentation which results in discounting them or accepting them as probabilities. The basic researcher usually works without reference to the practical use of the gained knowledge except in a very broad sense.

The information gained from basic research is applied to practical use by engineering methods. The engineer serves as a middleman between fundamental knowledge and the desired products or practical results. As used here, engineer is defined as one who uses a combination of art and science in application to social and economical purposes. Engineering methods consist of, (a) isolating the problems, (b) breaking each problem down into its component parts, (c) applying the appropriate fundamental ideas to the component parts, (d) compiling the results with tested methods, and (e) testing the products.

In both research and engineering, imagination is a prime essential. The basic researcher uses predominantly **creative** imagination. He derives new concepts from subtle hints of ideas or from small isolated facts in his findings. These new concepts must be tested by experimentation and observation to either prove them or discount them. The engineer uses **synthetic** imagination. He applies new concepts to old problems, old concepts to new problems, and both old and new concepts, collectively or in partial combinations, to all problems.

This is a very condensed and incomplete summary of the scientific method, but it will serve as a foundation on which to build a more affective and methodical approach to geological problems.

How it Works in Geology

Basic geological research is normally carried out in company research centers, at universities, by federal and state geological surveys, and by geological societies. This area of the science is progressing fairly rapidly although it is handicapped by many of its ideas being premature, necessitating later revision; or they are not adequately tested by experimentation and observation before formulation of results; or they are based on inconclusive evidence. Often this is due to a rush to "get into print." Basic research needs aid and support from the more practical geologist to be fully effective.

The majority of petroleum geologists are engaged in the task of ap-

This geologist declares:

"Engineering methods consist of, (A) isolating the problems, (B) breaking each problem down into its component parts, and (C) applying the appropriate fundamental ideas to the component parts. . .

"These methods are based on straight thinking, sound planning, efficient methods, and a set goal. . .

"The geologist . . . must be well informed on the validity and limitations of all geological methods—the different types of maps, cross-sections, diagrams, and pictorial illustrations. Very seldom are good ideas produced in a haphazard method. . .

"A geologist who comes to work only one day a year, but with a workable idea for finding an oil field on that day, would be worth more than one who worked every day of the year and only turned out a quantity of worthless maps and reports. Every geologist should work for creative application of his science."

"Cluttered minds are like cluttered maps—the desired result or information may be present but is not readily apparent."

plying fundamental geologic knowledge and methods to the search for oil. This application, to be fully effective, must be based on the previously mentioned engineering methods. These methods are based on straight thinking, sound planning, efficient methods, and a set goal. The goal must be attained in the shortest period of time, with a minimum of cost, and it must yield maximum benefits.

Step 1 . . . The first step is to isolate the problem. This seems evident. The problem is to find oil. But with further thought the problem of finding geologically suitable oil reservoirs can be broken down into its component parts. Each component part is a necessity or possibility for a petroleum reservoir. Each component part should be dealt with as an individual problem with its own background of fundamental knowledge and its own applicable methods of solution. For example, to produce a reservoir there must exist: (A) a trap, in the form of a closed structure, an updip pinchout of section or porosity, or any other retardative factor which prevents upward oil migration; (B) a suitable lithologic section, and; (C) a source of the oil. Each of these factors is an individual problem along with others which are inherent to different areas.

Step 2 . . . The second step is to propose one or more possible solutions to each problem. For instance, in a particular area the traps may be predominantly stratigraphic. This would serve as one solution to the (A) problem. All possible solutions are based on previous experience in the area or on experience in similar areas.

Step 3 . . . The third step is to evaluate the possible solutions by their previous success or failure under similar conditions, and concentrate on a single solution at a time. Again in our example, if it is decided that in a certain area the possibilities are best for stratigraphic traps, all the methods for locating stratigraphic traps can be used. A survey can be made of all current methods available with the effectiveness of each method for use in the plan. The method must fit the problem. It is possible and desirable to create new methods to solve these problems. A new method is the most desirable solution.

The problem now revolves back to the first step. The restated problem is what type of stratigraphic trap is present. Is it updip pinchout of section as in overlap? Is it loss of porosity or facies change? Again the process of isolation of the problem is repeated with concentration on single solutions.

After the problem has been literally torn apart and each part of it worked to the best possible solution, and not until then, the data is collected, organized, and compiled. This should bring out possible relationships of the necessary conditions to produce oil reservoirs.

The preceding example is not a completely formulated plan for this process, but it is hoped that it will stimulate thinking along this line.

One of the most important elements in such a procedure is the "set goal" as the definite aim of the method used for each problem. This gives the mental processes a direction in which to work. The oft used process of trying this way and that in the hopes that something will show up does not force the mind in any directive sense to a conclusion or idea.

Another important element is the isolation of the problem which allows the mind to work on a simpler situation. All problems are made up of a multitude of smaller problems. The method of scientific investigation is to isolate all these smaller problems to be worked out independently and if possible to further isolate still smaller components of them. The very process of isolating the problems helps to better understand them.

Cluttered minds are like cluttered maps—the desired result or information may be present but is not readily apparent.

The Individual Is Important

The effectiveness of any such procedure is still dependent upon the ability of the person using it. The geologist must be well informed on basic geologic knowledge, particularly that which directly concerns petroleum exploration; he must also keep up on new ideas resulting from basic research. He must be well informed on the validity and limitations of all geologic methods . . . the different types of maps, cross-sections, diagrams, and pictorial illustrations. Very seldom are good ideas produced in a haphazard method.

The geologist must be able to use creative and synthetic imagination to visualize the problems and to apply the proper methods to gain desired results. This is accepted as a fact by most thinkers but how does one actually accomplish it? Everyone uses his imagination, but an uncontrolled imagination is not efficient at solving problems with new ideas. How can we control and direct the creative imagination and apply it to geology?

The mind thinks in images and symbols. Even abstractions are visualized by the mind in symbolic geometrical patterns. The creative part of the mental makeup seeks the inner structural relationships of these patterns. If the thought pattern is unbalanced or out of proportion, the imagination supplies the missing pieces to make it complete.

How the mind recognizes the completeness or incompleteness of a thought pattern is a subject for which psychologists have found no answer. But we can accept this as a working hypothesis. Not until the thought patterns are completed or balanced can they be formulated into concepts, axioms or working ideas.

It has also been found that given a set goal or a definite problem to answer, the mind works amazingly in a direction toward that goal with seemingly little deviation onto fruitless tangents. This is attested to by Einstein in working out his space-time concepts.

It is not necessary to go into a more detailed study of the creative mental processes here to be able to understand the value of organized, methodical planning in the search for oil prospects.

Cause and Effect

For effective application of these processes to geological problems it is necessary to mention the cause-effect relationship involved. In analyzing the reasons for a particular oil trap, which would in this case be the effect, all the sufficient causes or conditions necessary to bring about the effect must be considered. By sufficient causes is meant all the conditions which resulted directly in the formation of the reservoir and its enclosed oil. If only part of the conditions are recognized, the necessary information for synthesis is not complete.

Of course, as a thing is capable of causing an effect only in relation to other things, the remote causes must be separated from the immediate causes. Most remote causes can be readily answered or assumed, such as the existence of the sedimentary basin or that the original oil-forming constituents were present in the basin. The important thing to remember is that all the conditions which bring

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"It could be assumed that all companies have maps on an area but the payoff is in ideas applied to these maps."

about the effect must be considered.

Any one minor condition may be the key to finding other fields in an area. The absence of this key condition, all other conditions being present, may make the difference between a producer or a "duster."

Small, seemingly obvious details, may be critical factors. Caution must be exercised in this, for just because things occur together does not necessarily mean that they are in a cause-effect relationship. For example, just because CO_2 gas and pyroclastics or intrusives often occur together does not necessarily mean that the gas was caused by the pyroclastics or the intrusives.

Quite possibly both are the result of some other common agency. This same thinking must be used in considering all the other possible cause-effect relations.

Prejudice Away

One detriment to creative imagination is prejudice. Prejudice is opinion or decision of the mind formed beforehand. With prejudice we too often interpret the evidence to fit out prejudice instead of seeking the real solution. Data is next to worthless if it is used to "prove my point." It should be used objectively and scientifically to find as nearly as possible what really is and not what "I think is." The only mental additives which should be used with this is a dose of creative imagination which conceives new ideas, and opinions which illuminates them.

Prejudice is often caused by generalizing. Generalization can be useful in putting outside limits on tentative exploration plans but it must be recognized for what it is. Generalizing can be used for relative evaluation of areas, but not for discounting them. Do not generalize from an individual case. It would be ridiculous to think that because one structure in a basin was dry that generally oil does not occur in structures there. Yet many generalizations, less obvious but just as invalid, are vogue in exploration activities.

The Data Survey

After the problem has been isolated, analyzed, and broken down into its smallest possible components, it is necessary to make a survey of all the data available on it. This data should include all the objective information such as surface information, information from bore hole investigations, paleontological data, geophysical dope, measured sections and published maps and reports. It should also include all the subjective information on the area, usually found in reports and maps such as geologic history, both stratigraphic and structural, all areal studies, and more specialized studies which may be valid in the area.

The information must be separated as to objective or subjective. The objective data in its strictest sense is real and not likely to change. It must be studied and organized into a usable form. This is usually done on forms, charts, graphs, or diagrams.

The subjective data can be used, changed, or discounted. This is one of the best areas for the introduction of new ideas. All previously published information on the area or all previously formed ideas on it must be critically examined. There are many possible interpretations which will fit the objective data, some better than others. Question all assumptions, particularly the seemingly obvious ones. Many things which we take for granted contain the key to the problem. Search the objective data for relationships and similarities. Try to mentally visualize the data in its space-time relations.

With proper application of basic geological knowledge, somewhere in this process the mind will formulate possible solutions to the problem. The number of possible solutions depends largely on the amount of basic knowledge. It is then necessary to work these possible solutions out in some form, usually as maps, cross-sections, diagrams, or other pictorial illustrations. This is another prime area for new ideas. A new and better way to diagramatically reach an answer to a problem, is a much desired solution.

Now Think!

Many problems are suspended where the real thinking should begin. Drawing structural, isopach, and facies maps on an area is only compiling information. Imaginative thinking really starts from this point on. The pictorial illustrations serve only as a basic foundation on which to hang ideas. In most cases they should not be expected to furnish completed answers for new oil fields. For this reason the maps should be kept flexible, with alternative interpretations kept in mind.

It could be assumed that all companies have maps on an area but the payoff is in ideas applied to these maps.

The job of the petroleum geologist it to find oil and not to find where it is not. But if in working with information in an objective way, the results all seem negative, the end result can still be profitable. A geologist can pay his own salary by saving the company money on worthless prospects.

Ideas may appear as "hunches" or as "getting the feel of an area" but these must in turn be subjected to critical examination in an objective way with the objective data. One method is to try the new idea on an existing field in the area to test its effectiveness. The real test is to drill it.

This, again, is not intended to be a completed working formula as it is important that each person work out an individualized plan for solving problems. In working out such a system, the individual will crystallize it in his own mind and his mind is apt to be more prolific on his own plan than on a borrowed one. The most important thing to remember is that the mind must be given a direction in which to think in order to create ideas and to answer problems efficiently.

New ideas are needed and useful in all fields of science and the field of geology is a particularly fertile field. The very nature of its largely inductive approach makes this true. One applicable idea is worth more than a storehouse of facts which are not utilized. A geologist who comes to work only one day a year, but with a workable idea for finding an oil field on that day, would be worth more than one who worked every day of the year and only turned out a quantity of worthless maps and reports. Every geologist should work for creative application of his science.

Capable Supervision a Must

It is obvious that no geological department can operate with any more effectiveness than the ability of the supervision. Too many supervisors have gained their positions with seniority and not ability. A good geologist is not necessarily a good leader.

There are two types of leadership. One is leadership by force; the other is leadership by the consent of those being led. It is undeniably the right of any company to appoint whosoever they please as a supervisor. But it is undeniably true that it is to their own advantage to appoint someone who can gain the full respect and cooperation of personnel working for him. This is especially important in a field where the creation of ideas is the primary product. An atmosphere of harmony, cooperation and a common goal is a necessity for this purpose.

It is not absolutely necessary for a supervisor to have a large stock of

Well—look at it this way— the **Journal staff** is continually on the watch for material most **helpful** to its readers. Realizing their readers' limited time, this material is **edited** and **illustrated** to put across a maximum amount of **information** in the very shortest reading time.

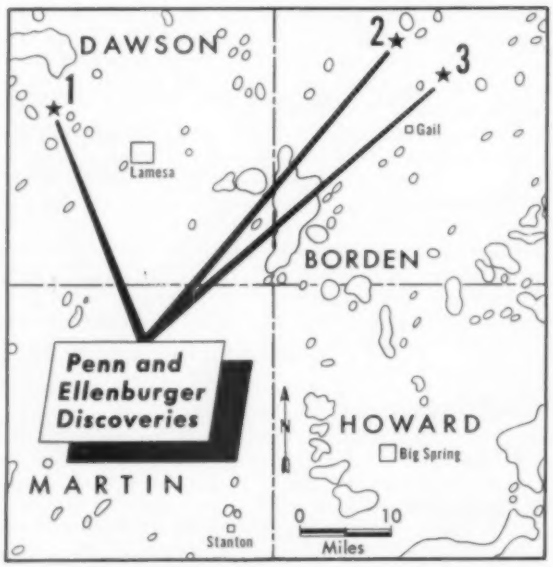
As a result, an award for editorial excellence has just been presented to the Journal. The Annual Refining Number was selected as one of the most outstanding single issues among industrial publications in 1957.

The Oil and Gas **Journal's aim** is to continue **presenting** the very best **information** to its readers every week . . . . . to help you stay *"in the know"* about all of the industry's developments and trends.

facts and figures in his mind. Specialized knowledge is one of the cheapest commodities in the world. A good leader must have general knowledge of the broader aspects of the program and its relation in the company organization. He must have the natural ability to get the most from every person, to realize necessities and unnecessities, to understand regional problems and the value and limitations of methods. He must encourage new ideas and methods and have the ability to see their merits or defects. These things are more important qualities in a leader than specialized knowledge.

Finally, geological leaders must have salesmanship ability to sell management on the soundness of the geological program and to inspire confidence in its decisions.

As with running a company, the program of the exploration department cannot be set up and standardized and left to run itself. The program must be flexible to allow each person to work at his best, with his own methods. The program must frequently be critically reviewed and revised for better productive geology.



1 . . . Dawson County Pennsylvanian reef discovery. Midwest Oil Corp. 1 Davis opened another pool in the "reef trend."

2 . . . Borden County dual discovery. Dunigan and Currey 1 Waddell made heavy oil flows from both Pennsylvanian and Ellenburger.

3 . . . Brown et al. 1 York had two prospective pay sections in the Pennsylvanian.

New pools for Texas

By CARL HOOT
District Editor

MIDLAND basin exploration has opened three new pools. In northwestern Dawson County, a reef discovery has been completed along the "reef trend" and in northern Borden County, one prospector had flowing oil from the Pennsylvanian and another found new production in both the Pennsylvanian and Ellenburger formations.

Dawson County . . . Midwest Oil Corp., Fort Worth, 1 Davis (No. 1 on the map), has been completed for 407 bbl. of 42°-gravity oil a day, with no water, from Pennsylvanian perforations at 8,491-8,500 ft. The flow was through 20/64-in. choke, with gas-oil ratio of 480:1. Tubing pressure was 225 psi.

No. 1 Davis drilled into reef porosity at 8,491 ft., and had total depth at 8,520 ft. First reported show of oil came on drill-stem test at 8,485-8,500 ft., and first heavy flow at 8,488-8,520 ft.

Location is in Section 60, Block M, EL&RR Survey, 10 miles northwest of Lamesa and 2 miles east of Pennsylvanian production in Mungerville field.

Borden County . . . James P. Dunigan and Currey Oil Co. 1 Waddell (No. 2 on the map), was near completion at this report. The well made a heavy flow of oil from the Strawn lime of the Pennsylvanian, at 8,381-8,499 ft. Gas surfaced in 4 minutes, at the rate of 2 M.M.c.f. per day, followed by oil in 12 minutes. Reports credited the well with making a "2-in. stream of oil." Bottom-hole flowing pressure ranged from 3,260-3,500 psi.

On test in the Ellenburger from 8,729-50 ft., the well also made a heavy flow of oil, with no estimate on the amount. Flowing pressure varied from 1,260-3,300 psi., increasing to 3,940 psi. when shut in. Top of the Ellenburger was 8,736 ft.

No. 1 Waddell was drilled on a Sinclair Oil & Gas Co. farmout. Location is in Section 20, Block 30, Township 6n., T&P Survey. It is 1½ miles southwest of the rapidly expanding U-Lazy-S field (Pennsylvanian and Ellenburger) and 2 miles west of a recent 1-mile south extension to that field.

James G. Brown & Associates et al. 1 York, also in Borden County, had prospects of production from two Pennsylvanian zones. Drill-stem tests recovered free oil at 7,809-23 and 8,057-96 ft.

At 7,809-23 ft., recovery in 2 hours was 1,736 ft. of oil, plus 186 ft. of oil-cut mud, and some sulfur water. At 8,057-96 ft., identified as lower Strawn, recovery was 1,123 ft. of free oil plus 210 ft. of oil-cut mud.

Operators drilled ahead to 8,297 ft., and ran casing to 8,289 ft. before making final tests.

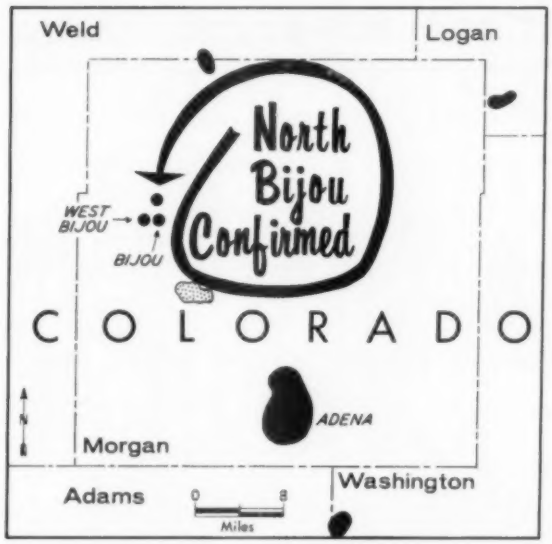
Location is 14 miles east of Gail, in Section 323, Block 97, H&TC Survey. Nearest Pennsylvanian production is West Myrtle field, but separated by an 8,300-ft. dry hole.

Northern Borden County had another Pennsylvanian and Ellenburger discovery prospect, not shown on the map. Harper & Huffman, Midland, 1 Frank Miller reported a flow of oil from the Ellenburger, plus recovery of oil on drill-stem tests of the Pennsylvanian.

Location is in Section 1, Block 30, Township 5s, T&P Survey, 8 miles northeast of Gail and about midway between the York and Waddell tests.

No. 1 Miller drilled into the Ellenburger at 8,505 ft., or minus 5,938 ft. A test at 8,505-20 ft. flowed oil in 55 minutes. After cleaning into pits, it was turned into tanks for 2 hours. The first hour it made 37½ bbl. and 34 bbl. the second hour. Bottom-hole flowing pressure ranged from 595-3,270 psi.

Previous shows of oil were from tests at 7,960-70 and 8,195-8,222 ft.



Confirmation in Colorado . . .

THE WEST OFFSET and confirmation well to new North Bijou field in Morgan County, Denver basin, Colorado, was completed flowing 1,055 bbl. of oil per day from perforations at 6,095-6,105 ft. in the D sand of Dakota-Cretaceous age. The well is Gulf Oil Corp. 1 Price-Persons, C SE NE 6-4n-59w. Location is 2 miles north of Bijou field and about the same distance northeast of West Bijou.

and North Dakota

THE RECENT Madison-Mississippian Pershing field discovery in McKenzie County, North Dakota, was confirmed last week by Amerada Petroleum Corp. The 1 Lillibridge, C SW SW 20-150n-96w, flowed 145 bbl. of oil and 127 bbl. of water daily from perforations at 9,506-76 ft. Flow was on 18/64-in. choke. This is the northwest offset to the discovery well which flowed 201 bbl. of oil and 7 bbl. of water daily from the Madison.

Three Baker Creek zones tapped by New Mexico well

THREE PAY ZONES were found by Pan American Petroleum Corp., in a semiwildcat 1 mile southeast of Barker Creek field in San Juan County, New Mexico.

Pan Am's D-1, Ute Mountain Tribal in NW¼ 10-31n,-14w, was drilled to total depth of 9,814 ft., plugged back to 9,751 ft. A total of 48 ft. of gas pays were found in the Paradox, topped at 8,080 ft.

On production tests through ¾-in. choke, the well flowed 9,600 M.c.f. sweet gas from perforations 8,248-64 ft.; 10,400 M.c.f. sweet gas from perforations 8,644-58 ft.; and 8,150 M.c.f. sour gas from perforations 8,762-80 ft.

Pan American owns the 100% working interest in the well, and in some 13 sections—about 8,500 acres—around it. This acreage includes Barker Creek field, which was first developed in the Dakota formation at 2,300-2,400 ft.

The D-1 enhances the prospects for developing important gas reserves on the southwest flanks of the Barker Creek anticline.

. . . and Texas well is gas-condensate discovery

AN IMPORTANT gas-condensate discovery in San Patricio County has been tested by Tidewater Oil Co. Tidewater's 1 Richardson, completed in the lower Frio, is 9 miles northeast of nearest production in the Commonwealth field.

On completion test the wildcat produced gas and an ungaged amount of distillate at the rate of 3,000 M.c.f.d. through a 10/64th choke from perforations at 10,866-95 ft. Tubing pressure was 5,100 psi. The well is now cleaning.

Tidewater owns 100% interest in more than 2,000 acres in the block. The test was originally scheduled to go to 11,500 ft., but the operators stopped at a total depth of 10,912 ft. because of abnormally high pressures encountered.

The well is on a 34.38-acre lease in the G. Valdez Survey some 3½ miles northeast of Gregory.

Bear Creek unit drilling in Oregon

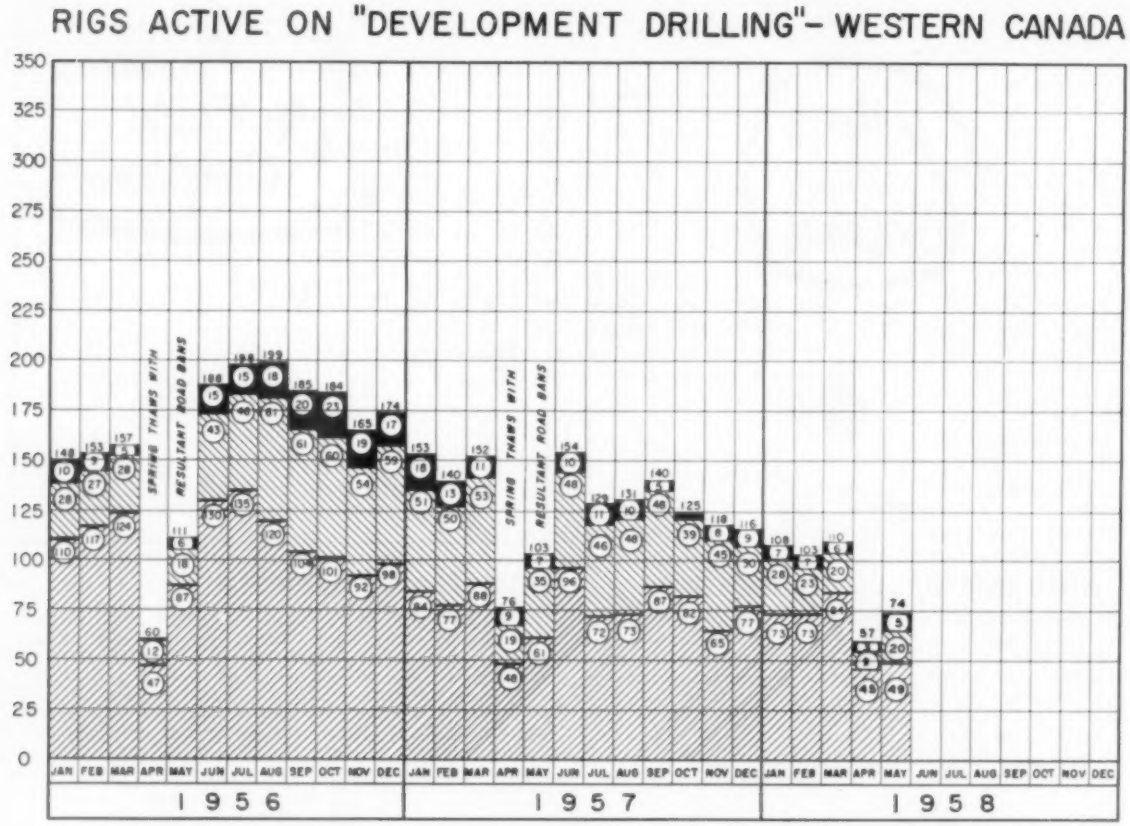
Sunray Mid-Continent Oil Co., acting as operator for itself, Standard Oil Co. of California, Lloyd Corp. and McCulloch Oil Exploration Co. of California, was drilling ahead below 2,658 ft. on 1 Bear Creek Unit in the southeast Prineville region of Oregon's Crook County.

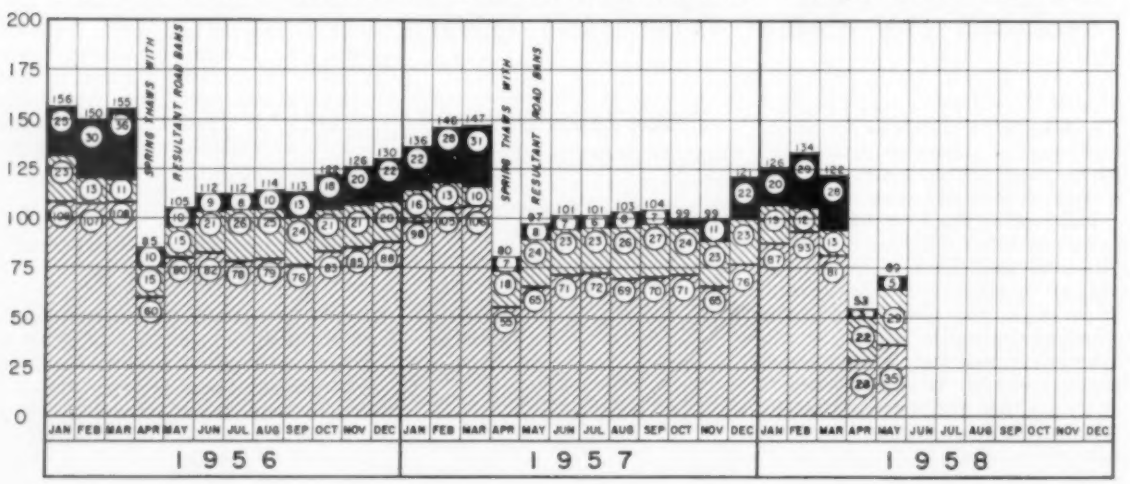
Oklahoma drillers succeed in well-deepening try

A NEW fault-block discovery in the first Bromide sand was reported at Sinclair Oil & Gas Co.'s 9 Donnell in Oklahoma's famed Golden Trend.

The well, located in Southeast New Hope field, Garvin County, flowed 97 bbl. of oil per day on 9/64-in. choke from the first Bromide-Ordovician sand at 9,260-82 ft. and 9,306-27 ft. The well also swabbed and flowed 32 bbl. of new oil in 10 hours through 2⅜-in. tubing from Gibson sand at 7,065-84 and 7,090-7,120 ft.

The Donnell, an oil well which had production in the Gibson in 1949, is located in NW NE 21-4n-3w. It was recompleted in the Gibson and deepened when production declined to about 3 bbl. per day. Nearest Bromide sand production is ¾ mile to the west.

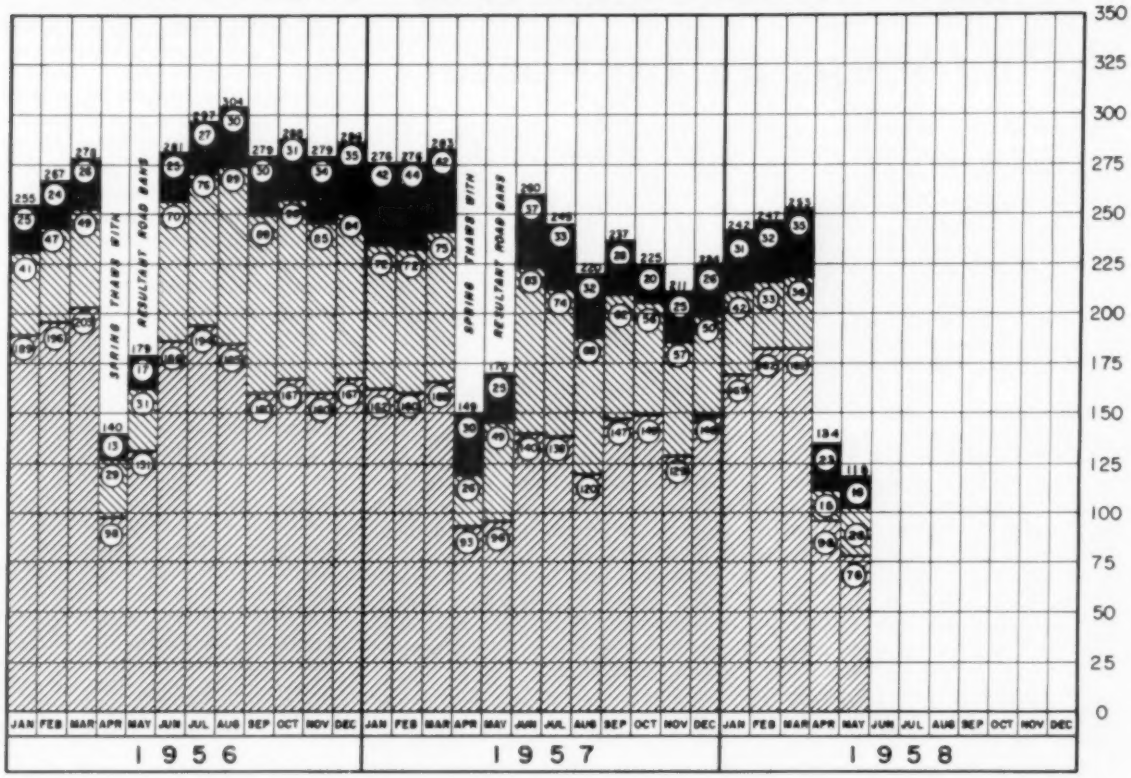




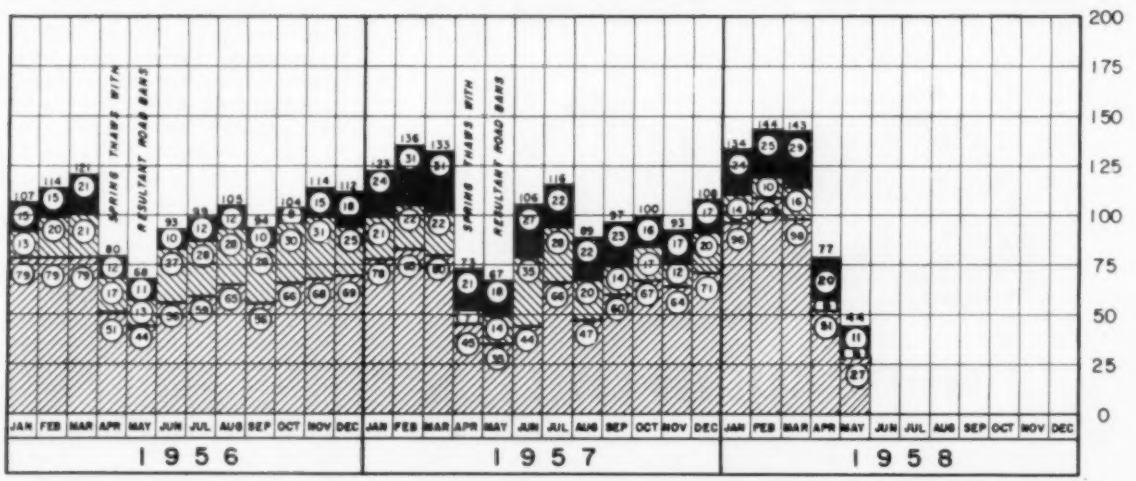
Oil hunting in Canada

THE NUMBER OF RIGS busy working in developed areas in western Canada (top chart) in May rose to 74 from the April figure of 57. This slight increase is normal each year. Alberta accounted for 49 of the field-well rigs, 20 for Saskatchewan, and 5 in British Columbia. Seismic crews in western Canada (bottom chart) normally increase in May over April. This remains true for 1958. Total crews out in the field hit 69, up 16 over April. A year ago there were 97 crews in the field in May, 80 in April; 2 years ago there were 105 crews out in May, 85 in April. The winter months show the highest number of crews out.

TOTAL DRILLING RIGS ACTIVE IN WESTERN CANADA



RIGS ACTIVE ON "EXPLORATORY DRILLING" – WESTERN CANADA



ALBERTA SASKATCHEWAN OTHERS

THE NORMAL INCREASE of active rigs in western Canada (top chart) in May failed to materialize in 1958. The total number of rigs active in the four western provinces dropped from 134 in April to 118 in May. During 1956 and 1957 (corresponding period) there was a noticeable increase after the spring thaw. Wildcat drilling in western Canada (bottom chart) normally drops in May from April figures. After the spring thaw and resultant road bans in May, wildcat rigs active dropped to 44 from April's 77. This is a larger drop than in previous years. In 1956 the April figure was 80; May was 68. In 1957 the April figure was 73; May 67. In May 1958 Alberta wildcatters had 27 tests going, 6 in Saskatchewan, and 11 in British Columbia and N.W.T. (Charts prepared by Nickle Map Service, Ltd., with information supplied by Daily Oil Bulletin.)

Southern, western Oklahoma drilling keeps up swift pace

EXPLORATION in Oklahoma continues strong, particularly in the southern, southwestern, and northwestern counties. Ordovician discoveries in southern Oklahoma, a Mississippian oil strike in a remote part of the eastern Palo Duro basin in Jackson County, and new Pennsylvanian oil and gas-condensate strikes in the northwestern and Panhandle counties lead state interest.

Bryan County . . . Sinclair Oil Co. completed an important regional discovery in a far-removed portion of the Ardmore-Marietta basin.

The 1 Anderson, SW NW NW 2-7s-9e, southeast of Durant, is a dual producer from McLish and Bromide sands of Ordovician age. The well flowed 1,470 M.c.f. of gas per day on 13/64-in. choke plus 75 bbl. of distillate from the McLish zone at 7,824-80 ft.; from Bromide at 7,196-7,259 ft. and 7,280-86 ft. it flowed 1,052 M.c.f. per day on 13/64-in. choke. The new pool is several miles from production.

Love County . . . Another important southern Oklahoma strike is Sinclair's 1 Tucker in NE NW SW 32-6s-3e, near Enville. This well was completed flowing 4 M.M.c.f. of gas per day and 97 bbl. distillate per million on 13/64-in. choke from open hole in the Oil Creek at 10,620-10,722 ft. The new area is just north of the Texas line.

Jackson County . . . In the extreme eastern end of the Palo Duro basin (Hollis basin), Atlantic Refining Co. is testing its 1 Hullett in NE SE NW 5-1n-23w, after finding oil in the Mississippian. Tests got 37 bbl. of oil in 9 hours on choke from perforations at 6,752-60 ft.

The well also had Strawn shows. It is located west of Altus in extreme southwestern Oklahoma. Successful completion will open a vast nonproductive area of this basin.

Cimarron County . . . Oil production was added to Southeast Griggs gas field in the southeast corner of this far northwestern Panhandle county.

The Texas Co. 1 Smith, C SE NW 25-1n-9eCM, pumped 121 bbl. of oil per day from Morrow-Pennsylvanian perforations at 4,656-64 ft. Development drilling continues steady in this area which is just north of the Sherman County, Texas line.

Ellis County . . . One of the most active northwestern Oklahoma counties added its fifth producing area.

Magnolia Petroleum Co. 1 Schoenhals, C NE SW 24-21n-26w, northwest of Shattuck, flowed 9 M.M.c.f. of gas per day from 9,242-61 ft. in the Morrow; 7,200 M.c.f. per day from 9,582-9,692 ft.; 13 M.M.c.f. per day from 9,762-75 ft. Another well has been begun at 1 Thompson in C SE NW 21-20n-23w.

Texas County . . . Republic Natural Gas Co. has two deep Pennsylvanian discoveries inside Hugoton field.

The 9 Cities Service-D, C SE SW 5-4n-13eCM, flowed 8,500 M.c.f. daily from Morrow sand at 6,077-89 ft.; the 3 Julian in C NW SE 3-5n-13eCM, recovered 2,280 ft. of oil on test of the Keyes sand at 6,104-22 ft.

California geology treated in new book

"A Guide to the Geology and Oil Fields of the Los Angeles and Ventura Regions," which made its first appearance at the recent national meetings of the AAPG and SEPM in Los Angeles, is now available for sale by mail, according to Harold H. Sullwold, Jr., chairman of the convention field trip committee.

Attractively bound in blue Fabrikord and stamped with gold letters, the book contains 232 pages, including 88 illustrations. It was edited by James W. Higgins, district geologist for Standard Oil Co. in Los Angeles, and includes 10 regional type papers, 19 oil-field papers (10 fields never before published), 4 road logs, 1 air-tour log, 2 correlation charts, and an aerial mosaic of the Los Angeles Basin. Single contributions include S. G. Wissler's up-to-date correlation chart of the Los Angeles Basin, W. H. Holman's new correlation chart of the Ventura basin, W. F. Barbat's Los Angeles Basin review article, and A. F. Woodward's description of the Sansinena oil field.

The volume may be purchased for $7.00, from the Pacific Section, AAPG, care of Martha Gallagher, Kern Oil Co., 900 Wilshire Blvd., Los Angeles 17, Calif.

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Lea County Vacuum Wildcat Completed

SINCLAIR Oil & Gas Co. has completed its 1 State-Lea "405" as a Devonian discovery in 27-18s-35e. Location is in a hot new area south of Vacuum field, 2 miles northwest of the South Vacuum unit discovery in Section 35, and 1 mile south of Sinclair's recent Bone Spring discovery in Section 22.

No. 1 State-Lea completed for a swabbing potential of 350 bbl. of 47°-gravity oil, plus 108 bbl. of formation water, from Devonian perforations at 11,769-74 ft. Gas-oil ratio was 84:1. Total depth is 11,783 ft.

This is the well which flowed oil from the Bone Spring limestone at 8,513-8,658 ft. during drilling operations. Sinclair plans to drill two other wells in the immediate area.

Sinclair's 2-401 State-Lea, approximately 1 mile to the northwest of the above discovery, had total depth at 11,765 ft. and was running casing for completion tests. This well recovered free oil on two drill-stem tests in the Devonian and flowed oil from a section of the Wolfcamp. Location is 14 miles southwest of Lovington in 21-18s-35e.

Wolfcamp opener . . . Cabot Carbon Co. 1-F State, located on the west flank of Pennsylvanian production in Townsend field, in 4-16s-35e, completed as a flowing Wolfcamp discovery. Potential was 624 bbl. of oil a day, through 22/64-in. choke, from perforations at 11,875-88 ft. Flowing pressure was 675 psi. Total depth at 13,403 ft. was in dry Devonian rocks.

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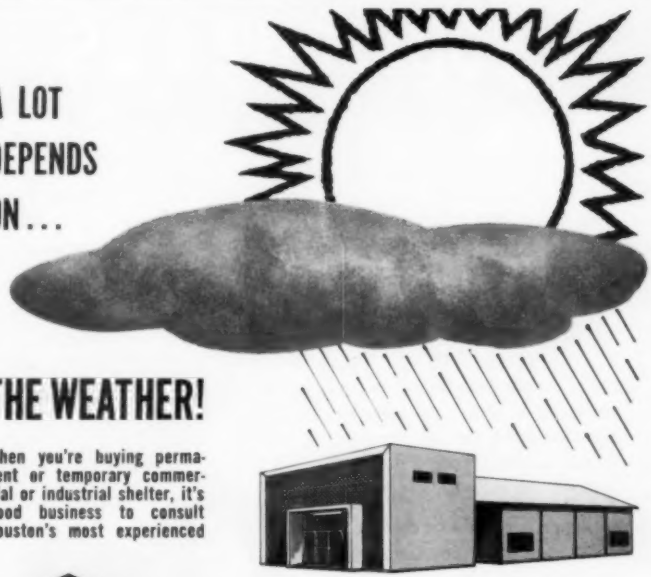

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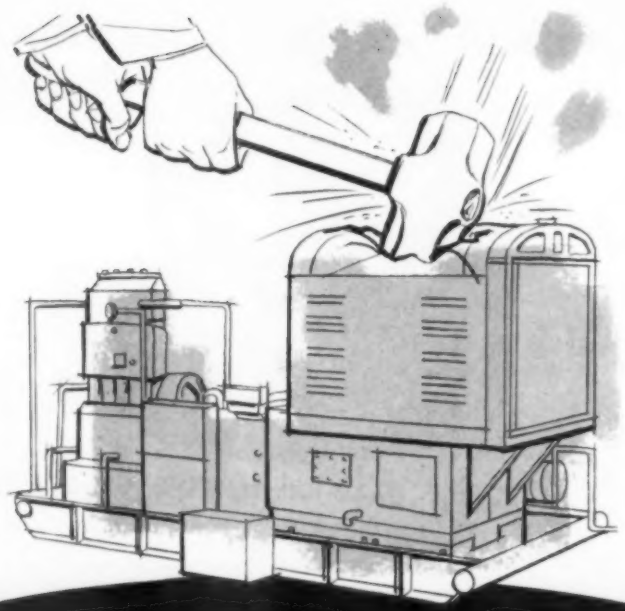

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New hit extends Michigan's Scipio

FIRST good extension of the year-old Scipio field, Hillsdale County, A. E. Rovsek's Wood 1, NW SE SW 3-5s-3w, ½ mile northwest of nearest producing well, completed for 115 bbl. oil per day after 100-qt. nitro shot in Trenton pay. The 11 previously completed successful oil wells are strung out 1¼ miles southeast three locations wide at the greatest width.

Rovsek's stepout well logged Trenton at 3,576 ft. and was bottomed at 3,994 ft., showing water at 3,988 ft. Hole was plugged back to 3,947 ft. for the shot set at 3,903 ft. Well carried about 100 ft. of oil natural.

McClure and Aurora 1 Haven, NW NE NW 14-5s-3w, farthest southeast production drilled in Scipio field to date, gaged 75 M.M.c.f. of gas to set a record for the field and for the Trenton horizon in Michigan. Gas pay was killed by water injection and liner cemented at 3,786 ft. to permit deepening into lower oil sections. Well had flowed 1,500 bbl. oil from present 3,786-ft. depth but after tubing produced only gas.

Wyoming has strike in Wind River basin

THE extreme southeast corner of the Wind River basin in Wyoming picked up a new Muddy-Cretaceous strike last week.

This new field opener is True Oil Co. 1 Weisel in C NW NE 5-31n-84w, 1½ miles east of Ritter field and 3 miles southeast of Grieve field. Both of these fields have Muddy sand production.

The True discovery flowed 275 bbl. of oil per day from the Muddy.

Louisiana hit brings Wilcox production

NEW WILCOX SAND oil production was opened at a wildcat 1 mile northeast of Omega in western Concordia Parish, East Central Louisiana. The field opener is Norman Germany-G. W. Gulmon A-1 E. B. Wade in C E½ SE NE 19-7n-7e, 1 mile south of Wildsville field and 2 miles north of the town of Security.

The well flowed 127 bbl. of 42°-gravity oil daily on 10/64-in. choke from perforations at 4,911-14 ft. An east offset is planned immediately.

Despite some activity

California wildcatting dwindles

WILDCATTING was at a postwar low in California. The state, however, was not without its interesting drilling projects.

No one area was dominating the scene, but these were generally conceded to be among the more interesting tests underway:

. . . In the North Tejon field of Kern County, Reserve Oil & Gas Co. completed its deepest test in the field to date. The well, 361-19 W-T, was drilled to 14,488 ft. plugged back to 14,105 ft. and completed in the Vedder Z-4 sand at 11,998-12,127 ft. It was turned to the tanks flowing at a rate of 878 bbl. daily of 34.5°-gravity crude through a 24/64-in. choke.

Prior to plugging it back for the Z-4 completion, Reserve tested deeper zone with unrevealed results. This year-old field currently has four rigs active on extension tests.

. . . In the Los Angeles Basin, two recent completions pointed up the growing importance of the Newhall-Saugus area.

Edward Lustgarten's new Bouquet Canyon field discovery cleaned up to less than a 3% water cut after experiencing water difficulties. This test, 1 Lucky Lusty, was holding up at a steady 45 bbl. daily of 40°-gravity crude from a shallow zone at 2,344-2,415 ft.

About 1 mile west of Lustgarten's new-field discovery, Union Oil Co. completed an excellent extension test in the deeper Saugus productive area. The well, B-2 N. L. & F, started flowing to the sump at a 20-bbl.-an-hour rate through a 74/64-in choke initially. It settled down to around 360 bbl. daily of 28.7°-gravity crude from selectively perforated intervals between 10,370-10,575 ft.

. . . Also in the Los Angeles Basin, but in the metropolitan area itself, Signal Oil & Gas Co. had both its golf-course wildcat projects under way in West Los Angeles.

The latest is 1 Rancho, spudded on a drill site on the city-owned Rancho Golf Course. Signal is operator for itself and Richfield Oil Corp. on a 185-acre lease which includes the golf course and the adjacent city-owned playground.

Earlier last month, Signal spudded in a similar test on the private Hillcrest County Club next to Rancho. This test was drilling below 4,255 ft.

Both the Rancho and Hillcrest operations are unique in extent of soundproofing and landscapping involved. Both are using electrical power.

. . . At Redondo Beach where Signal has been conducting a highly successful drilling project of this small beach city's tidelands from an onshore site, Signal recently spudded the first test of the city's onshore acreage. Signal is using the same drill site used to drill the offshore parcels.

The test is being directionally drilled to bottom within a 21-acre unit included in a total of 200 acres in townlot leases held jointly by Signal, Reserve Oil & Gas Co., Redondo Exploration Co. and the ABSCM group. This latter group consists of Anderson-Prichard Oil Corp., Bandini Petroleum Corp., American Climax Petroleum Corp., Southern California Petroleum Corp., and Merchants Petroleum Corp.

California highlights . . . O. M. Slosson solved the water problem which plagued his recent new-pool discovery in the Tejon Hills of Kern County. Prior to the successful water shutoff, the well was cutting 68% on its 80-plus-bbl.-a-day production. After

NEW FROM JENSEN

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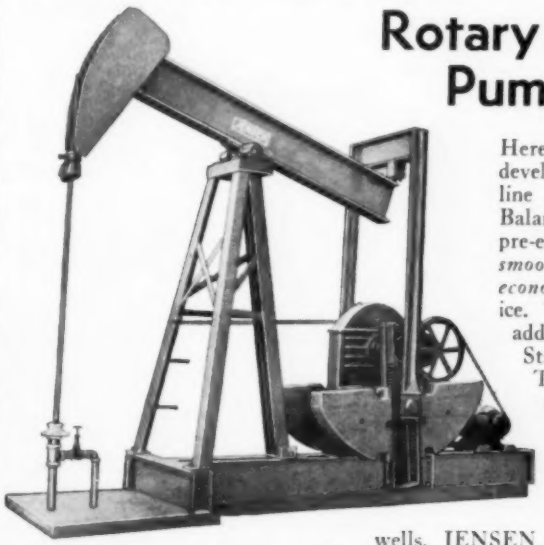

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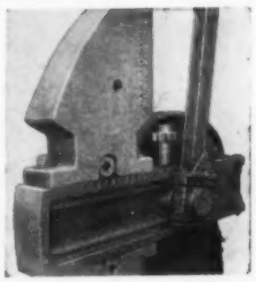

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the water shutoff, it has been making around 100 bbl. daily cutting only 0.1%. This discovery is ½ mile west of the nearest Tejon Hills field well.

In a rare cable-tool project, Lester I. Bartlow appeared to have a shallower pool discovery in the Simi field of Ventura County. The Bartlow test indicated an entry rate of 28 bbl. daily on a bailing test for water shutoff after standing 12 hours. Oil in the hole had risen 75 ft. in the 248 ft. hole. The operator was installing blowout equipment before drilling ahead.

California new-field discovery rumored

RICHFIELD OIL CO. is drilling ahead at a rumored new-field discovery in the San Emidio Nose area of Kern County, California. The tight hole is KCL "H" 34-9 in 9-11n-21w. Drilling is below 11,599 ft.

Unofficial reports say the well recovered considerable oil on tests at the 11,500-ft. level. The wildcat was slated as a Stevens (Miocene) test to 13,000 ft. Nearest production to the possible discovery is 4 miles southeast at Shell Oil Co.'s Pleito Ranch which was confirmed last week for 325 bbl. per day from Stevens.

This is Richfield's second deep wildcat at San Emidio this year. The company went to the Stevens and abandoned the KCL "H" 33-15 at 14,471 ft. That well is 1 mile southeast of the rumored strike.

Eastern Kentucky gets light producer

IN BREATHITT COUNTY and located on the south end of Puncheon Camp pool, Cumberland Petroleum Co. is completing its 1 Dora Gilbert as a light producer.

From an elevation of 979 ft., drillers topped the producing Corniferous limestone at 1,881 ft. and penetrated that formation to 1,939 ft. total depth.

Well is currently pumping 5 to 10 bbl. of oil daily.

Successful Wildcats

ALBERTA

Alberta Pacific 7-10-14-15 Vauxhall, LSD 7, 10-14-15w4. Sawtooth oil discovery. TD 3,410 ft.

Hudson's Bay 6-4-31-28 Olds, LSD 6, 4-31-28w4. D1 gas discovery. TD 8,120 ft.

Canadian Export Gas 10-29-34-7 Loyalist, LSD 10, 29-34-7w4. Viking gas discovery. TD 2,869 ft. Husky A7-31 Alberfeldy, LSD 7, 31-49-26w3. Sparky oil discovery. TD 1,773 ft.

Permo et al. 7-27-40-10 Thompson Lake, LSD 7, 27-40-10w4. Cameron sand oil discovery. TD 3,130 ft.

Texaco B6-17-6-2 Castle River, LSD 6, 17-6-2w5. Devonian D1 gas discovery. TD 13,498 ft.

Midwest 2B-4-58-11 Saddle Lake, LSD 2, 4-58-11w4. Colony sand gas discovery. TD 1,687 ft.

SOUTH LOUISIANA

Acadia Parish: California Co. and Sinclair Oil & Gas Co. 1 LeBlanc, 9-9s-3e. IP 110 BOPD, 3/32-in., 39.4°, GOR 730 cu. ft. per barrel, TP 1,500 psi., perfs. 9,732-54 ft. TD 14,209 ft. (New pay and extension South Bosco field.)

Beauregard Parish: Penton & Penton 1 Lutcher-Moore, 19-6s-11w (1 mile south of Bearhead Creek field). IP 112 BOPD and 1,100 M.c.f. daily, 5/32-in., 59°, TP 1,900 psi., perfs. 8,508-18 ft., TD 8,709 ft. (New field.)

Iberia Parish: California Co. 5 Williams, Inc., 27-12s-11e. IP 120 BOPD and 6,500 M.c.f. daily, ¾-in., 50.3°, TP 3,900 psi., perfs. 11,578-88 ft. TD 12,200 ft. (New pay in North Bayou Long field.)

Jefferson Davis Parish: San Jacinto Oil & Gas Co. 2 Louisiana Rice Milling Co., 41-9s-3e. IP 132 BOPD, 7/64-in., 35°, GOR 950 cu. ft. per barrel, TP 1,900 psi., perfs. 10,094-10,102 ft., and (dual completion) 165 BOPD, 7/64-in., 36°, GOR 650 cu. ft. per barrel, TP 1,350 psi., perfs. 9,614-20 ft. TD 11,510 ft. (Second well and new pays for North Jennings field.)

Orleans Parish: Kenneth A. Meredith and Reese A. Carter 1 State Lease 3327,

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Township 11s-5e, in Lake St. Catherine. Shut-in gas well, no gage, perfs. 5,436-48 ft. TD 5,500 ft.

Plaquemines Parish: Tidewater Oil Co. 1 State Lease 192, 5-21s-29e (4 miles southeast of Bastian Bay field). IP 4,700 M.c.f. daily, 7/32-in., spray condensate, 45.8°, TP 4,375 psi., perfs. 13,050-75 ft. TD 13,210 ft. (New field.)

St. Landry Parish: Tidewater Oil Co. 1 Haas, 10-6s-5e. IP 233 BCPD with 2,400 M.c.f. daily, 11/64-in., 57.3°, TP 3,560 psi., perfs. 10,380-94 ft. TD 11,986 ft. (Extension and new pay for Opelousas field.)

St. Mary Parish: Southwest Gas Producing Co. and Argo Oil Co. 1 Dupuy, 33-13s-9e. IP 5,600 M.c.f. daily, 10 BO per M.M.c.f., 40.7°, TP 4,260 psi., perfs. 11,698-11,710 ft. TD 12,893 ft. (Extension and new pay Jeanerette field.)

Terrebonne Parish: Mississippi River Fuel Co. and Hope Natural Gas Co. 3 State Lease 3141, Township 23s-16e, in Pelican Lake. IP 109 BCPD and 6,563 M.c.f. daily, ¼-in., 52.2°, TP 5,250 psi., perfs. 12,165-71 ft., 12,173-79 ft., 12,181-87 ft., and 12,189-92 ft. TD 13,450 ft. (Second well, 1-mile east extension, and new pay for Pelican Lake field.)

Vermilion Parish: Union Oil Co. of California 1-F Louisiana Furs, Inc., 4-16s-2e (4 miles north of Fresh Water Bayou field). IP 352 BOPD and 4,425 M.c.f. daily, ¼-in., 48.2°, TP 3,200 psi., perfs. 13,310-25 ft. TD 14,570 ft. (New field.)

Charles B. Wrightsman 1 Archie Petry, 6-11s-2e. (2 miles north of Leleux field). IP 194 BOPD, ⅛-in., 32.4°, GOR 721 cu. ft. per barrel, TP 1,600 psi., perfs. 10,064-70 ft. TD 12,101 ft. (New field.)

Sid Richardson Carbon Co. 1 Leo Bonin, 14-11s-2w (3 miles northeast of West Guyedan field). IP 102 BOPD and 3,400 M.c.f. daily, ⅛-in., 56.8°, TP 9,900 psi., perfs. 15,025-66 ft. TD 15,255 ft. (New field.)

OFFSHORE LOUISIANA

East Cameron Area: CATC (Continental Oil Co.) 6-A OCS-0163 (State Lease 1208), Blk. 71. IP 4,960 M.c.f. daily, $\frac{7}{16}$-in., GLR 133 M.c.f. per barrel, 48.7°, TP 6,725 psi., perfs. 10,041-50 ft., and 10,028-36 ft. TD 10,385 ft. (New pay in East Cameron Block 71 field.)

West Cameron Area: Union Oil Co. of California 1 OCS-0259, Blk. 67. IP 107 BOPD and 5,325 M.c.f. daily, ¼-in., 41°, TP 3,720 psi., perfs. 11,345-55 ft. TD 13,078 ft. (New field.)

Eugene Island Area: Pure Oil Co. 3 OCS-0196 (State Lease 832), Blk. 32. IP 98 BOPD, ⅛-in., 39.2°, GOR 475 cu. ft. per barrel, TP 960 psi., perfs. 6,418-34 ft. TD 6,583 ft. (New pay in Eugene Island Block 32 field.)

Ship Shoal Area: Kerr-McGee Oil Industries, Inc., 1-G OCS-0346 (State Lease 750), Blk. 28. IP 732 BOPD and 9,000 M.c.f. daily, 11/32-in., 49°, TP 3,900 psi., perfs. 14,196-14,230 ft. TD 14,350 ft. (New pay in Ship Shoal Block 28 field.)

South Timbalier Area: Gulf Oil Corp. 3-A OCS-0456, Blk. 130. IP 284 BOPD, 9/64-in., 38.8°, GOR 505 cu. ft. per barrel, TP 1,225 psi., perfs. 8,355-64 ft. TD 8,558 ft. (New pay in South Timbalier Block 131 field.)

MICHIGAN

Isabella County: Neyer, Miller, and Gallagher 1 Cotter, NW NW NW 5-15-5w. Nottawa Township. 5 miles east of Coldwater field. IP 58 BOPD, 12/64-in. choke in 24 hours after 380-gal. acid treatment. Elev. 931 ft. Traverse 3,216 ft., Dundee 3,816 ft. Pay 3,823-24 ft. TD 3,824 ft. New oil discovery.

MISSISSIPPI

Franklin County: Serio-Punches Oil Co. 1 A. W. Anderson estate, 26-5n-1e. IP 165 BOPD, ⅛-in., 41°, TP 430 psi., perfs. 6,467-68½ ft. (Wilcox). TD 6,657 ft. Elev. 164 ft., Wilcox 4,435 ft., base Baker shale 6,260 ft. (New field—North Flat Rock.)

Jasper County: Gulf Oil Corp. 1 Z. B. Soso Field Unit 28-7, Lot 11, 28-10n-13w. IP 316 BOPD, 5/32-in., 39.5°, TP 1,570 psi., perfs. 12,598-12,617 ft. (Hosston), and 122 BOPD, open head, 33°, TP 65 psi., perfs. 15,247-56 ft. (Cotton Valley). TD 19,040 ft. Elev. 321 ft., Lower Cretaceous 8,330 ft., Hosston 12,322 ft., Cotton Valley 13,772 ft. (New pays in Soso field.)

Pearl River County: Jett Drilling Co. and Crosby Mineral Co. 1 Southern Mineral Co., 27-1s-17w. IP 3,170 M.c.f. daily, $\frac{7}{16}$-in., 17 BC per M.M.c.f., TP 3,257 psi., perfs. 9,010-18 ft. (Tuscaloosa). TD 9,559 ft. Elev. 197 ft., lower Tuscaloosa 8,892 ft., Massive 9,251 ft., Lower Cretaceous 9,454 ft. (New field—Stewart.)

SASKATCHEWAN

Mobil-Sohio X12-14 West Ralph, LSD 12, 14-7-14w2. Midale oil discovery. TD 4,520 ft.

TEXAS GULF COAST

Bee County: Lawrence Shelly and J. E. Hillier 2 Clara Driscoll Estate, Thomas Banuelos & Stepsons Sur., A-2 (4 miles southeast of Skidmore). Absolute open-flow potential 12,800 M.c.f. daily, dry gas, shut-in TP 1,793 psi., perforations 4,442-52 ft. TD 5,514 ft. (New field).

W. B. Cleary, Inc., and James A. Heliand 1-B Clara Driscoll Estate, Thomas Banuelos & Stepsons Sur., A-2 (4 miles east of Skidmore). Absolute open-flow potential 1,360 M.c.f. daily, GLR 110.8 M.c.f. per barrel, 36°, shut-in TP 1,511 psi., perforations 4,365-69 ft. (Frio). TD 5,055 ft. (New gas reservoir in West Heard area.)

Calhoun County: Superior Oil Co. 3 Maude B. Traylor, Phillip Dimmitt Sur., A-11 (6 miles northwest of Olivia). IP 164 BCPD and 3,560 M.c.f. daily, $\frac{9}{16}$-in., 51.5°, TP 5,200 psi., perforations 9,668-78 ft. (Frio). TD 11,336 ft. (New pay in North Maude B. Traylor field).

Sun Oil Co. 2 E. D. White, William Arnold Sur., A-2. IP 143.65 BOPD, $\frac{11}{16}$-in., 39.1°, GOR 705 cu. ft. per barrel. TP 520 psi., perforations 7,688-7,700 ft. (Frio). TD 8,648 ft. (New pay in Appling field).

Chambers County: Tennessee Gas Transmission Co. 1 State Tract 308, Galveston Bay. IP 133.16 BOPD, ¼-in., 36.1°, GOR 498 cu. ft. per barrel, TP 225 psi., perfs. 10,338-44 ft. (Frio). TD 11,807 ft. (New pay in Southwest Red Fish Reef field.)

DeWitt County: Coloma Oil & Gas Corp. 1 Amelia Boldt, P. C. Ragsdale Sur., A-414 (6 miles southeast of Yorktown). IP 101.21 BOPD, 9/64-in., 48.3°, GOR 326 cu. ft. per barrel, TP 300 psi., perfs. 4,484-92 ft. (Yegua). TD 5,016 ft. (New reservoir and extension for West Holly field.)

Goliad County: Slade Oil & Gas, Inc., 6 Albrecht, George Elliot Sur., A-119 (8 miles northwest of Goliad). Absolute open-flow potential 3,050 M.c.f. daily, dry gas, shut-in TP 970 psi., perfs. 2,504-08 ft. (Frio). TD 5,108 ft. (New pay in Karen Beauchamp field.)

Hardin County: Oil Reserves Corp. 1 Kirby-Casanova, M. M. S. Casanova Sur., A-11 (13 miles northwest of Saratoga). Absolute open-flow potential 8,200 M.c.f. daily, dry gas, shut-in TP 2,170 psi., perfs. 5,571-75 ft. (Yegua). TD 6,910 ft. (New field—5 miles southwest of Segno field.)

Jackson County: Texkan Oil Co. 1 L. H. Yendrey Unit, Sec. 2, Hays Ranch Subd., J. Yeamans Sur., A-304 (8 miles northwest of Edna). Absolute open-flow potential 86,000 M.c.f. daily, dry gas, shut-in TP 1,143 psi., perfs. 2,657-60 ft. (Miocene). TD 5,610 ft. (Outpost and new-pay discovery in Carmichael field.),

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Sinclair's Brett Steps Up

. . . another notch to Tulsa division manager. The one-time roustabout started with the company in 1929 as a clerk.

SINCLAIR OIL & Gas Co. picked a man who started at the bottom and rose through the ranks to head its Tulsa division.

He is Floyd Brett, 50, who started with Sinclair in 1929 as a clerk in Tulsa.

A vice president of Sinclair, Brett was promoted to Tulsa division manager this month to succeed W. R. (Dick) Thixton, who retired.

Brett is known as a modest, unassuming man, reticent to talk about himself. He gets the job done with the least amount of fanfare.

Although he has a youthful appearance—with a touch of grey at his temples to give him a distinguished look—Brett can call on more than 30 years experience to aid him in his new post.

Brett is in charge of exploration, production, and gasoline and gas-products divisions of Sinclair in Oklahoma, Kansas, North Dakota, Indiana, Illinois, and Kentucky.

The type of man who finds desk work confining at times, (some of his "most enjoyable" years were spent in field work) Brett is looking forward to making regular trips to the district offices in his division. Those include four gas-products plants, nine production district offices, and five district exploration offices.

Background . . . Being headquartered at Tulsa puts Brett near his boyhood homes at Sapulpa, Kiefer, and Jenks.

Born August 12, 1907, in Buffalo, Kans., Brett's parents moved to Sapulpa when he was 2 years old. His father, Otto H. Brett, an employe of Gulf Oil Corp. before his retirement, still lives in Sapulpa.

Young Brett decided early on a career in the oil industry. He started out as a roustabout with Gulf during summer vacation periods to help finance his education at Oklahoma State University at Stillwater.

After graduation in 1929 with an electrical engineering degree, Brett took the job as a clerk in Sinclair's Tulsa office. He spent the first 3 years with the company in the gasoline

Personals

George S. Patterson, formerly district superintendent for Cities Service Pipe Line Co., has been named manager of Everglades Pipe Line Co. He will headquarter in Miami, Fla.

C. L. Franke, chief engineer of Pacific Petroleums, Ltd., has joined Plymouth Oil Co. as Calgary regional production superintendent. Franke was production engineer with Gulf Oil Corp. until joining Merrill Petroleums, Ltd., in 1953. Merrill later was merged with Pacific Petroleums.

W. H. Drushel has been appointed general superintendent of drilling and production in The Texas Co.'s South Texas division, domestic producing department. Drushel, assistant general superintendent of the division since last year, succeeds **R. B. Leggett,** who has retired. Leggett had been general superintendent of the division since 1947.

J. B. Ladd has resigned as production manager of Consolidated Oil & Gas Co., Denver, to join the petroleum department of First National City Bank, New York, as senior petroleum engineer.

T. S. Zajac, Denver area chief mechanical engineer for Shell Oil Co., has been named Pacific Coast area gas manager. He will be succeeded in Denver by **R. J. Bauer,** who transfers from the Houston office.

Daniel P. Barnard, research coordinator in the Chicago general office of Standard Oil Co. (Ind.), will retire July 1. Barnard served as a Deputy Assistant Secretary of Defense in 1954 and 1955 and has been on loan to the Defense Department periodically since that time. He will continue as a consultant to the Defense Department. Barnard joined Indiana Standard in 1925 as assistant director of research.

Lawrence Indergard, Carter Oil Co. geologist, has been transferred to Vernal, Utah, from Billings, Mont.

Max V. Mossholder has been named manager of Titan-Tex Drilling & Production Corp.'s new Abilene, Tex., district office.

Victor V. Graf, manager of research, engineering, and supply, for Seismograph Service, Ltd., British subsidiary of Seismograph Service Corp., has been appointed assistant to the president of the parent company. He will headquarter in Tulsa.

A. A. Brown, senior geologist, formation evaluation, for California Standard Co., has been appointed chief development geologist. **S. McGehee,** formerly division gas engineer for The California Co. in Harvey, La., has been named staff supervisor, gas, for California Standard. Both will headquarter in Calgary.

and gas-products department before transferring to production. He worked at various engineering and production posts in East Texas, West Texas, and New Mexico before returning to Tulsa in 1950.

Brett took time out from company business during the Korean war in 1951 to serve with the Petroleum Administration for Defense in Washington. He was an analyst in the products division of PAD, allocating tubular goods to major operators.

Back in Tulsa, he became general production superintendent in 1953, and a year later was named assistant division manager at Fort Worth. He was promoted to manager of the Midland division in May 1956, and was elected a vice president of Sinclair in August 1956. Brett was transferred to the Tulsa division the first part of this year.

Family . . . Brett and his wife, Merlene, have one son, Dale.

The boy didn't follow his father into the oil business. Brett recalls his son "made up his mind in the eighth grade he was going to be a doctor—and he stuck with it." His son, now married, received his degree this month from the University of Oklahoma medical school.

Brett is proud that his son chose medicine for a career. As for his own career, he figures he picked the right one "and I'd make the same choice if I had it to do over again."

George F. Cannedy, engineer with Texas Illinois Natural Gas Pipeline Co., has been transferred to Jackson, Mo., from Conroe, Tex.

James R. Stewart, engineering trainee with Carter Oil Co. in Great Bend, Kans., has been transferred to Standard-Vacuum Petroleum, N. V., on Sumatra as production engineer.

R. E. Luton, vice president of refining for Ohio Oil Co., has been elected a director. He succeeds **H. C. King,** financial vice president and a director, who is retiring July 1. King has been with Ohio since 1921.

W. R. Mendenhall, special representative for California Crude Sales Co. in Perth Amboy, N. J , has joined The California Co. as assistant manager, crude oil, natural gas, liquefied petroleum gas, and natural gasoline sales division. He will headquarter in New Orleans. Both companies are subsidiaries of Standard Oil Co. of California.

John Niles Gray, formerly district superintendent for Sinclair Venezuelan Oil Co., has opened geological and petroleum engineering consulting offices in Olathe, Colo.

A. D. Hunt, J. D. Ratcliffe, and **G. L. Gray** have formed a new consulting firm, Hunt, Ratcliffe & Gray, in Calgary. Hunt and Gray were formerly with Canada Southern Petroleum, Ltd.

Edwin L. Gorham, Jr., manager of The Texas Co.'s foreign producing department (Western Hemisphere and West Africa), becomes general manager of the department. He succeeds **A. W. Baucum,** who was recently named Texaco vice president in charge of domestic producing.

C. Leslie Rice has resigned as vice president and a director of Empire Trust Co. to join Jonnell Gas Co. as a general partner and to become chief executive officer of Gulf Resources, Inc. Jonnell has gas reserves in Zapata and Starr counties, Texas. Reserves will be dedicated to Gulf Resources, which plans to build a 125-mile pipeline and gathering system from Zapata County to La Salle County, Texas.

Personals

P. C. Lauinger, publisher of The Oil and Gas Journal, received an honorary doctor of laws degree at Georgetown University's commencement exercises last week. A 1922 graduate of Georgetown, Lauinger is a member of the University president's council, an advisory group. His son, **Philip Lauinger,** was a member of the graduating class this year.

Warren R. Crouse, formerly coordination engineer with Tidewater Oil Co. in Avon, Calif., has joined the California Bay area air-pollution control district as principal air-pollution engineer. He will headquarter in San Francisco.

W. E. Heater, American Overseas Petroleum, Ltd., has been elected president of the eastern section of American Association of Petroleum Geologists. **Ben F. Uhl,** Conorada Petroleum Corp., is vice president. **Richard C. Hasson,** Arabian American Oil Co., will be secretary with **Marion R. deEscallon,** American Overseas Petroleum, as treasurer.

Canadian Will Head Scouts and Landmen

William P. Allen, seated, far right, chief scout of Imperial Oil, Ltd., was elected president of the National Oil Scouts and Landmen's Association at the group's annual meeting in Tulsa. Allen is the first Canadian to hold the office. Other new officers are, seated, left to right, George Hogan, La Gloria Oil & Gas Co., editor in chief; W. F. Taylor, Superior Oil Co., third vice president; Leland Abel, Magnolia Petroleum Co., secretary-treasurer; Ernest Allerkamp, Standard Oil Co. of Texas, second vice president; Mal Kidwell, Shell Oil Co., first vice president; and Allen. Standing are retiring officers, left to right, George B. Ross, Humble Oil & Refining Co., editor in chief; Charles Kelly, Sun Oil Co., third vice president; Daniel Greene, Magnolia, secretary-treasurer; J. B. Johnson, Sohio Petroleum Co., second vice president; Walter B. Holley, Lion Oil Co., Division of Monsanto Chemical Co., first vice president; and George D. Echols, Standard Oil Co. of Texas, retiring president.

BULLARD SOLLIDAY YOST BEDFORD

Pan American Shifts Top Management

E. F. Bullard, president of Pan American Petroleum Corp., becomes chairman of the board and A. L. Solliday, executive vice president, moves up to president in changes affecting Pan Am's top management.

F. R. Yost, vice president in charge of exploration, will succeed Solliday as executive vice president. C. F. Bedford, recently named vice president in charge of production for Pan American International Oil Co., has been recalled from New York and named vice president, production, and a director of Pan Am. Bedford replaces Frank Lindeman, Jr., who resigned to become a consultant.

Bullard has been president of the company since 1945 when he succeeded Frank Prior. He had formerly been executive vice president, vice president, and a director. Solliday was vice president in charge of operations and a director before becoming executive vice president in 1947.

Yost is a former operating superintendent, production manager, and Gulf Coast division manager of the company. He became vice president, exploration, in 1956. Bedford was general superintendent of the producing department before his assignment in New York with Pan Am International, a subsidiary, was announced recently.

Dr. Bernard M. Sturgis, director of Du Pont Co.'s petroleum laboratory, has been named secretary of American Chemical Society's division of petroleum chemistry. He succeeds **W. G. Lovell,** Ethyl Corp.

Harry J. Peckheiser, Kansas City marketing division manager for Socony Mobil Oil Co., has been named vice president and director of marketing for General Petroleum Corp., Socony's West Coast affiliate. He succeeds **Baxter F. Ball,** recently named general sales manager of Socony.

C. F. JONES

Dr. Charles F. Jones has been named manager of the refining department of Humble Oil & Refining Co., succeeding **Russell H. Venn,** who has been named manager of the company's newly-organized marketing department. Jones joined Humble in 1937 in the technical-service division of the Baytown, Tex., refinery. He has been serving as technical assistant to the manager since 1956. Venn joined Humble as a junior chemical engineer at the refinery in 1934 and became manager of the refining department in 1955.

Kenneth E. Hill, vice president of Chase Manhattan Bank, has been proposed for membership as a general partner in Eastman Dillon, Union Securities & Co., effective July 1. Hill joined Chase Manhattan's petroleum division in 1946.

J. H. Rice, manager of Ohio Oil Co.'s pipeline department, has been named president of Wabash Pipe Line Co., new pipeline subsidiary formed by Ohio and Continental Oil Co. Vice presidents of the company are **R. M. Slough,** assistant manager of Ohio's pipeline department, and **W. L. Kygar,** president of Continental Pipe Line Co. **Calvin A. Brown** of Ohio Oil is secretary. Assistant secretaries are **R. H. Brown,** Ohio; **John D. Morrow,** secretary, coordinator, and assistant to the president of Continental Pipe Line; and **P. J. Dominic,** secretary of Continental Oil. **C. A. Jackson,** Ohio Oil treasurer, will be treasurer of the subsidiary. **L. C. Peters,** financial vice president of Continental, and **S. F. Nash,** Ohio, are assistant treasurers. Directors of the new company are Rice, Jackson, Kygar, **K. E. Tappy,** Ohio's Wyoming division superintendent; **H. R. Wall,** Fort Worth region manager of manufacturing for Continental; and **John L. Kelly,** vice president in charge of operations for Continental Pipe Line.

Glenn L. Blackman, Harper Oil Co., has been elected president of the Oklahoma City Geological Society succeeding **Neal H. Potts** of William Ross Cabeen & Associates. Other officers are **William L. Duggan,** Magnolia Petroleum Co., vice president; **J. W. McHugh,** The Texas Co., secretary; **Neal Neece, Jr.,** Lone Star Producing Co., treasurer; and **G. Gilbert Tubb,** Magnolia, editor.

Fred E. Moran, Owensboro, Ky., independent, has been elected president of Kentucky Oil and Gas Association. He succeeds **O. H. Horne,** Inland Gas Corp. **C. E. Goodwin,** United Fuel Gas Corp., was named an association vice president. Four reelected vice presidents are **E. E. Clark,** Kentucky-West Virginia Gas Co.; **E. A. Owens,** Ashland Oil & Gas Co.; **E. J. Reading,** Sun Oil Co.; and **V. O. Sims,** Felmont Oil Corp. **Angus McDonald,** Lexington, continues as secretary. **Robert Reilly** is executive secretary-treasurer.

A. G. BAILEY

A. G. Bailey, vice president and general manager of Bailey Selburn Oil & Gas, Ltd., has been elected president of Alberta Gas Trunk Line Co., Ltd. He succeeds **Vernon Taylor** of Imperial Oil, Ltd. Taylor is current president of the Canadian Petroleum Association. **R. J. Dinning** will continue as chairman of the Alberta Gas Trunk Line. **George E. Church,** vice president of the company since 1956, has been named first vice president. **D. C. Jones,** assistant manager of production for Hudson's Bay Oil & Gas, Ltd., and a Trunk Line director since 1955, was elected second vice president. **J. C. Mahaffy** will continue as general manager.

A. L. Seelinger, Socony Mobil Oil Co. de Venezuela production manager, is being transferred to Libya as general manager of Socony Mobil's operations in that North African country. **J. H. Poe,** manager of services for Socony in Venezuela, will succeed Seelinger as production manager. The transfer will move three more Caracas officials up a notch in the Socony organization. **C. A. Gruver,** now assistant production manager, becomes services manager; **N. S. Dismukes,** chief petroleum engineer, moves up to assistant production manager; and **K. W. Wiseman,** assistant chief petroleum engineer, becomes chief petroleum engineer.

Personals

C. R. BROWN

Charles R. Brown, vice president and general manager of Tidewater Oil Co.'s central division in Tulsa, has been transferred to San Francisco as western division general manager. Brown replaces **Thomas L. Wark,** who has been appointed special assistant to the president. **Lloyd Armstrong,** assistant general manager of the company's southern division in Houston, moves to Tulsa to take over as division general manager succeeding Brown.

Robert J. Finney, assistant to the vice president of Cities Service Research & Development Co., has been named president and general manager of F-M Oil Co., Landsdale, Pa., a newly formed affiliate of California Oil Co.

George T. Piercy, general manager of supply for Esso Standard Oil Co., has been named assistant manager of the coordination and petroleum economics department of Standard Oil Co. (N.J.). **Donald M. Cox,** assistant general manager of supply for Esso, moves up to manager succeeding Piercy.

A. H. Newberg, formerly chief engineer for Service Pipe Line Co., will serve as office engineer at Williams Brothers Co.'s McKeesport, Pa., field office on a summer vacation job during construction of the 43-in. and 55-in. Carnegie Natural Gas Co. project. Since leaving Service last year, Newberg has been a student at the Episcopal Church Divinity School of the Pacific, Berkeley, Calif.

G. E. WYNN

G. E. Wynn, executive vice president of D-X Sunray Oil Co., has been elected president and a director of Suntide Refining Co. He succeeds **F. L. Martin,** who has resigned to become an independent refinery consultant. Martin has been hired as consultant to Suntide over a 10-year period. Suntide was organized in 1952. Negotiations by Sunray Mid-Continent Oil Co., parent of D-X Sunray, to acquire Suntide were announced by both companies last month but the deal has not yet been completed.

Monroe E Spaght, executive vice president of Shell Oil Co., has been awarded an honorary doctor of science degree by Rensselear Polytechnic Institute, Troy, N. Y.

Phil Gass has been elected a senior vice president and member of the executive committee of the management board of Northern Natural Gas Co.

Dr. Sylvain J. Pirson, petroleum engineering professor at the University of Texas, will lecture on oil reservoir engineering this summer in France, England, and Italy. Pirson will lecture June 23-27 at the French Institute of Petroleum in Paris and July 20-August 1 in London.

W. F. Lechtenberg, district geophysicist for Mobil Producing Co. in Casper, Wyo., has been transferred to Ankara, Turkey, as geophysical supervisor with Mobil Exploration Mediterranean, Inc. **P. A. Mundt,** geologist at Billings, Mont., with Mobil Producing, also transfers to Ankara. Both companies are subsidiaries of Socony Mobil Oil Co., Inc.

MANGELSDORF

Harold G. Mangelsdorf, has been named deputy coordinator of worldwide refining activities of Standard Oil Co. (N.J.) He has been chairman of Jersey's advisory committee on human relations since 1956. Mangelsdorf joined the Jersey companies in 1934 with Esso Standard Oil Co. He later was general superintendent of Esso's Bayway refinery, Linden, N. J., manager of Esso's East Coast refineries, and manager of all Esso manufacturing. He became a director and member of Esso's executive committee in 1955.

P. C. Spencer, chairman of the board and chief executive officer of Sinclair Oil Corp, last week received an honorary degree of doctor of humane letters from Clarkson College of Technology, Potsdam, N. Y.

DEATHS

Thomas D. Humphrey, 71, longtime Dallas independent and driller of many of the famed Kilgore, Tex., wells, died June 10 in Dallas. Humphrey was founder and managing general partner of Thomas D. Humphrey & Sons. He entered the oil business in Wichita Falls in 1918 and drilled his first well in Burkburnett pool in 1919. He later drilled more than 100 wells in East Texas field and many others in other areas of East, West, Central, and North Texas. One of his top discoveries was Ham Gosset pool in Kaufman County.

Alexander J. Duaei, 68, founder and president of Pipe Line Service Corp, Franklin Park, Ill., died recently in Hartford, Conn. Duaei founded Pipe Line Service, protective-coating applicators, in 1931. He remained as president after the company became a subsidiary of American Steel Foundries in 1955.

P. Floyd Hoss, 70, Tulsa independent operator, died June 7 in a Tulsa hospital. Hoss had been active in the oil business since 1908.

H. J. Davis, 46, manager of the lube-oil department of Shell Oil Co.'s Houston refinery, died June 9 at his home in Houston. He had been with Shell 23 years.

D. A. Burris, Mount Pleasant, Mich., independent operator, died May 30 after a long illness. He had been active in Michigan since 1933.

Philip J. Gale, 54, president of the old Interstate Petroleum Co., died June 4 in Chicago after a heart attack.

J. A. Buxton, 81, retired Tulsa drilling contractor, died June 4 in Tulsa after a long illness.

Charles A. McNamara, Sr., 71, Tulsa, retired superintendent of materials for Sinclair Oil & Gas Co., died June 5 in an Oklahoma City hospital. McNamara retired in 1950 after 30 years with Sinclair.

Francis M. Blair, 54, Houston independent oil operator, died June 6 in a Houston hospital.

J. S. Young, Jr., 86, Lawrenceville, Ill., oil producer and contractor, died late last month.

Hal S. Eddings, 50, vice president of Coastal Plains Oil Co., Houston, was killed in an airplane crash in Guatemala June 3. Also killed were **Thomas Crooke,** of New York, pilot of the plane, and an unidentified Guatemalan.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,225,750	UP	8,075	DOWN	949,179
Crude stocks	268,794,000	DOWN	1,031,000	DOWN	330,000
Completions	879	DOWN	13	DOWN	32
Refinery runs	7,690,000	UP	203,000	DOWN	390,000
Gasoline stocks	193,290,000	DOWN	65,000	DOWN	8,000
Kerosine stocks	22,344,000	UP	875,000	DOWN	3,804,000
Distillate stocks	93,037,000	UP	5,179,000	DOWN	8,752,000
Residual stocks	62,810,000	UP	1,427,000	UP	21,564,000
Four-product stocks	371,481,000	UP	7,416,000	UP	9,000,000
Total imports	1,462,700	UP	236,900	DOWN	19,900

Gasoline prices are firmer

. . . but still are way too low

BY JOHN C. CASPER
Economics Editor

GROUP 3 GASOLINE PRICES are moving up. The increase of half a cent a gallon brings the low for 89-octane regular to 11.75 cents a gallon. Major suppliers are posting 12.00 cents a gallon, but any private-brand distributor, served from the Great Lakes Pipe Line, can find supplies at 11.75 cents plus pipeline charges.

Some suppliers in the Mid-Continent areas sent notices to their customers late in May that gasoline prices would be advanced, effective June 2. Other refiners did not raise their prices until June 9. During this first week of June there was a question whether the new quotation would be met by some suppliers in the area. However, the new price now seems to be reasonably well established.

Unbranded distributors probably were able to buy gasoline at the old price between the first announcement of the increase and the time when most suppliers met the higher posting. Part of this material may be available at slightly lower prices until sometime after the middle of the month.

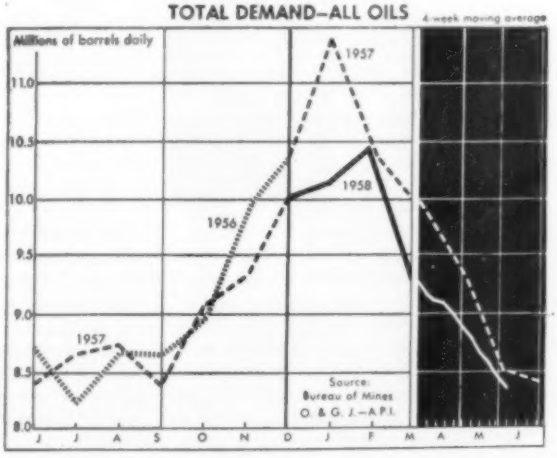
Refiners in all areas of the country have been under extreme pressure from low prices caused by surplus product inventories over the past year. Disappointing levels of domestic demand and decreased exports following the opening of the Suez Canal were not balanced by cuts in refinery runs until stocks were too high. The result was low product prices.

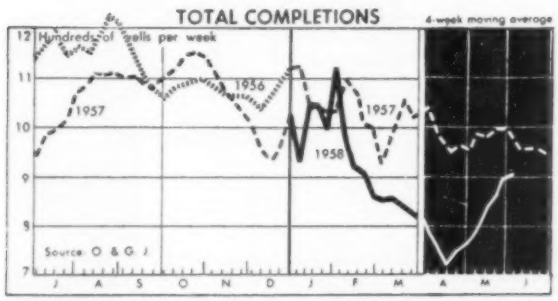
Even with the latest increase, gasoline prices are too low. Petroleum product prices have tended to lag wholesale prices in general. For example, Group 3 regular gasoline was selling for 10.5 cents a gallon on the Group 3 market early in the summer of 1948. The current posting of 11.75 cents represents a gain of 11.9% over the 1948 price. The Department of Labor's report of wholesale prices for commodities other than farm prices and food shows a gain of 21.1% for the same period. Since the summer of 1953, Group 3 regular-gasoline price has increased 4.4%. All commodities other than farm products and food have moved up 9.8%.

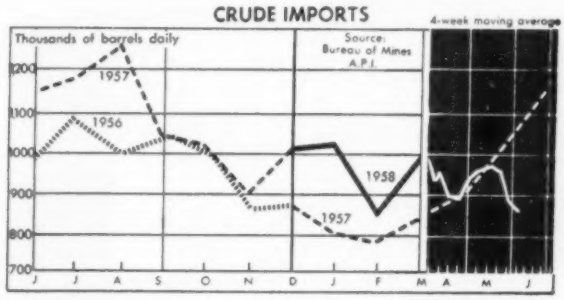
Even these comparisons do not tell the whole story as they make no allowance for improvements in gasoline quality. Also, low prices are not limited to the Group 3 area.

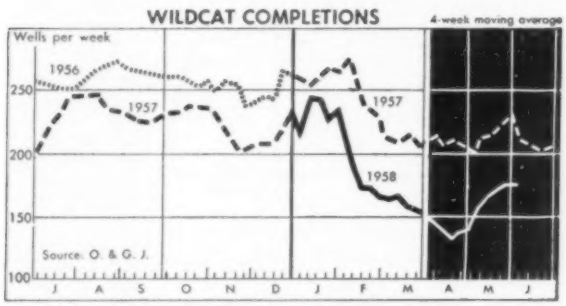
Regular gasoline on the Gulf Coast cargo market is selling for less than it did in the summer of 1948. The barge price of 8.85 cents a gallon for No. 2 fuel on the New York market is lower than for 7 out of the past 10 summers. Gulf Coast distillate has been lower in only 3 out of the past 10 years.

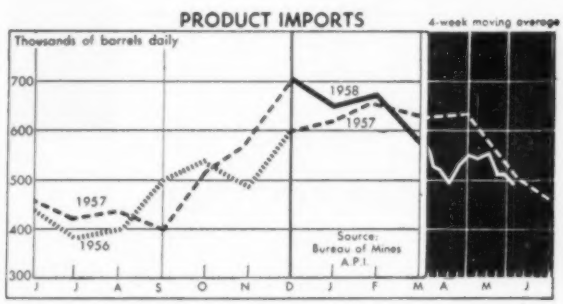
Refiners need a half-cent increase in prices of both gasoline and distillate fuels before the end of July.







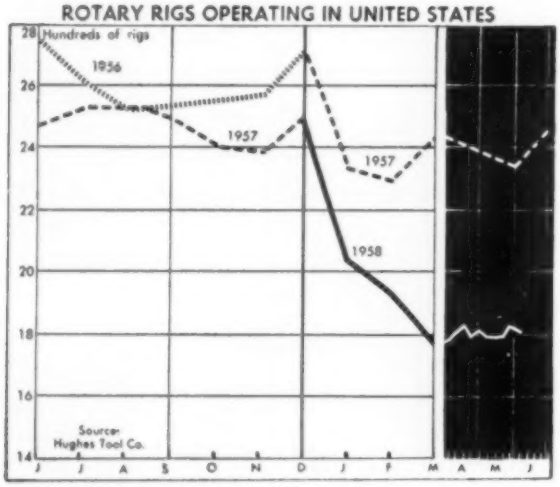




WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 7, 1958

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	6	3	0	0	3	0	30,286	35	51	3	0	0	0	3	13	19
Arkansas	15	7	0	2	6	0	58,054	280	409	2	1	0	0	1	70	67
California	22	16	0	0	6	0	97,290	772	961	7	1	0	0	6	159	239
Colorado	13	4	0	0	9	0	61,106	315	371	9	0	0	0	9	168	249
Illinois	44	14	0	0	30	0	22,415	818	1,050	12	0	0	0	12	171	256
Indiana	15	7	0	0	8	0	21,821	282	277	4	0	0	0	4	107	55
Kansas	73	37	0	3	31	2	256,190	1,554	1,793	16	5	0	0	11	316	349
Kentucky	15	6	0	0	9	0	12,699	388	601	0	0	0	0	0	45	114
Louisiana	65	31	4	5	25	0	462,260	1,425	1,630	11	0	1	1	9	209	291
North	26	15	0	4	7	0	81,141	480	541	3	0	0	1	2	76	66
South	36	13	4	1	18	0	354,101	748	775	8	0	1	0	7	118	185
Offshore	3	3	0	0	0	0	27,018	197	314	0	0	0	0	0	15	40
Michigan	7	3	0	1	3	0	19,430	164	171	3	0	0	1	2	53	69
Mississippi	4	1	0	0	3	0	30,561	159	160	3	0	0	0	3	83	79
Montana	10	6	0	0	4	0	46,781	154	146	4	0	0	0	4	65	51
Nebraska	15	5	0	0	10	0	89,427	280	345	10	2	0	0	8	134	194
New Mexico	43	22	0	12	9	0	186,238	811	875	3	0	0	0	3	109	122
West	25	7	0	12	6	0	111,823	375	330	2	0	0	0	2	48	46
East	18	15	0	0	3	0	74,415	436	545	1	0	0	0	1	61	76
New York	12	5	0	0	2	5	21,401	239	204	2	0	0	0	2	16	1
North Dakota	9	3	0	0	6	0	65,192	183	122	4	0	0	0	4	61	49
Ohio	24	13	0	6	5	0	73,010	442	445	0	0	0	0	0	5	3
Oklahoma	113	66	3	5	36	3	414,282	2,851	2,756	17	3	1	1	12	383	316
Pennsylvania	0	0	0	0	0	0	0	184	354	0	0	0	0	0	6	35
Texas	348	189	11	21	108	19	1,447,400	7,809	9,517	63	7	2	1	53	1,607	2,444
District 1	21	7	0	1	13	0	42,545	439	537	9	1	0	0	8	178	181
District 2	18	4	3	0	11	0	103,342	323	316	5	0	1	0	4	86	128
District 3	32	12	1	2	17	0	187,874	565	786	5	0	0	0	5	115	243
District 4	14	6	2	1	5	0	93,316	516	643	5	1	1	1	2	156	239
East	25	12	2	0	11	0	119,668	534	545	9	0	0	0	9	151	168
District 7-B	41	20	0	1	15	5	124,199	1,012	1,262	7	1	0	0	6	286	473
West	104	81	2	1	19	1	468,771	2,322	2,675	14	1	0	0	13	320	404
District 9	73	39	0	4	17	13	209,684	1,558	2,157	7	1	0	0	6	269	567
District 10	20	8	1	11	0	0	98,001	540	596	2	2	0	0	0	46	41
Utah	7	4	0	0	3	0	41,969	190	73	3	0	0	0	3	35	42
West Virginia	8	0	0	5	3	0	19,026	290	264	0	0	0	0	0	9	11
Wyoming	11	5	0	2	4	0	60,153	313	347	2	0	0	0	2	89	116
Miscellaneous	0	0	0	0	0	0	0	40	30	0	0	0	0	0	34	25
Total U. S.	**879**	447	18	62	323	29	3,536,991	19,978	22,952	**178**	19	4	4	51	3,947	5,196
Total prev. week	892	437	30	50	354	21	3,582,224	.....	.....	172	12	5	5	150	.....	.....
Cum. 1958	19,978	9,934	500	1,487	7,585	472	84,508,392	.....	.....	3,947	373	69	125	3,380	.....	.....
Western Canada	61	32	0	7	22	0	250,645	981	1,120	16	3	0	3	10	347	303

ROTARY RIGS OPERATING IN UNITED STATES

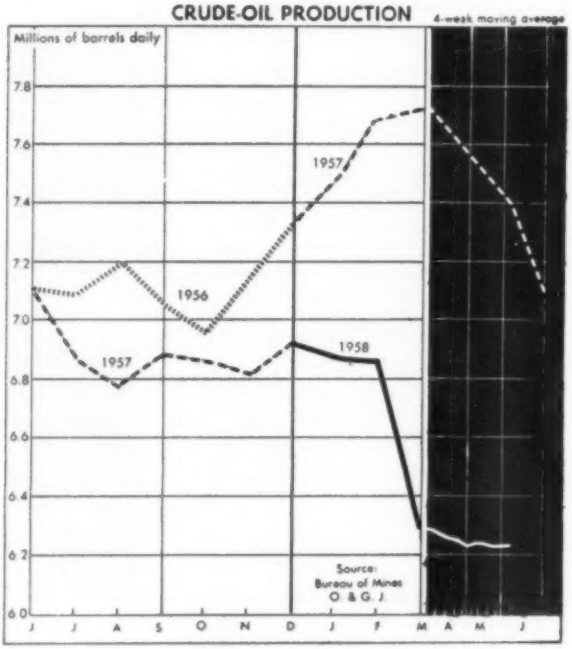


ACTIVE ROTARY RIGS*

	6-9-58	6-2-58	5-26-58	6-10-57
Alabama	5	5	7	10
Arkansas	24	24	11	20
Arizona				
California	78	81	75	96
Colorado	36	33	30	45
Florida	1	1	1	1
Georgia	1	1		
Idaho				
Illinois	52	54	54	58
Indiana	10	7	10	6
Iowa	3	3	3	2
Kansas	141	134	128	160
Kentucky	12	9	7	10
Louisiana	270	279	281	430
North	35	39	36	56
South	193	197	201	273
Offshore	42	43	44	101
Maryland				
Michigan	5	9	7	11
Missouri				1
Montana	15	19	21	29
Mississippi	39	39	37	37
Nebraska	24	28	30	35
Nevada				
New Mexico	123	129	128	138
New York	2	2	2	
North Dakota	34	37	33	25
Ohio				1
Oklahoma	173	176	188	218
Oregon	1	1	1	1
Pennsylvania	10	10	10	15
South Dakota				2
Texas	643	642	640	928
Gulf Coast	126	121	129	199
Offshore	3	3	4	4
West	250	258	264	373
North	220	215	203	295
East	44	45	40	57
Tennessee				
Utah	36	36	37	42
Washington				
West Virginia	8	5	5	2
Wyoming	57	58	52	75
Virginia				
Total United States	1,803	1,822	1,798	2,398
Western Canada	155	160	160	234
Eastern Canada	3	1	2	1
Grand total	1,961	1,983	1,960	2,633

*Hughes Tool Co.

CRUDE-OIL PRODUCTION



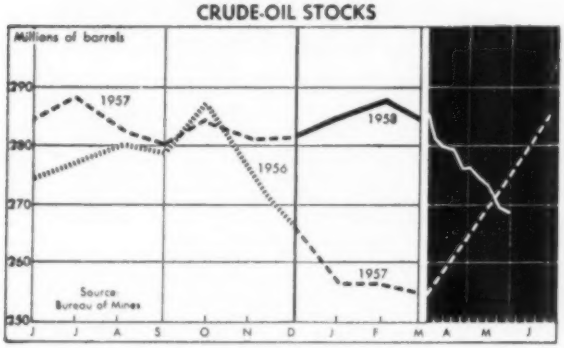
DAILY AVERAGE PRODUCTION FOR WEEK

June 7, 1958

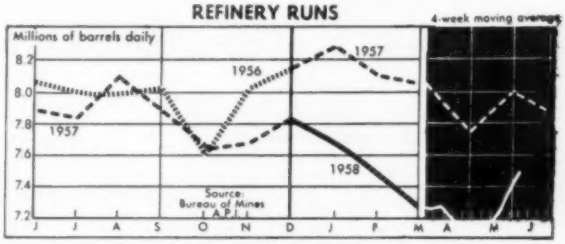
	Crude oil	Lease condensate	Total	May 31 total
Alabama	14,925		14,925	14,900
Arkansas	75,500	200	75,700	75,675
California	850,300		850,300	855,600
Colorado	135,200		135,200	136,325
Eastern	49,800		49,800	50,400
Florida	1,275		1,275	1,275
Illinois	215,600		215,600	219,200
Indiana	30,700		30,700	30,800
Kansas	†293,600		†293,600	†325,200
Kentucky	41,900		41,900	42,100
Louisiana	728,800	86,675	815,475	812,450
North	110,800	2,900	113,700	113,850
South	618,000	83,775	701,775	698,600
Michigan	26,000		26,000	26,200
Mississippi	93,200	4,500	97,700	102,450
Montana	73,750		73,750	70,900
Nebraska	52,625		52,625	51,100
Nevada	100		100	100
New Mexico	248,300	5,700	254,000	253,350
North Dakota	36,250		36,250	39,350
Oklahoma	†524,700		†524,700	†541,700
Texas	2,205,000	65,000	2,270,000	2,198,000
Dist. 1	45,500	400	45,900	45,400
Dist. 2	90,000	8,600	98,600	96,000
Dist. 3	315,000	32,000	347,000	347,000
Dist. 4	163,000	8,200	171,200	159,600
Dist. 5	25,500	300	25,800	25,500
Dist. 6	92,000	7,000	99,000	98,000
East Texas Field	120,000		120,000	116,000
Dist. 7-B	122,000	100	122,100	122,100
Dist. 7-C	117,000	4,050	121,050	113,650
Dist. 8	817,000	1,900	818,900	776,600
Dist. 9	192,000	1,800	193,800	191,500
Dist. 10	106,000	650	106,650	106,650
Utah	70,500		70,500	67,500
Wyoming	295,500		295,500	302,950
Others	‡150		‡150	‡150
Total U. S.	6,063,675	162,075	**6,225,750**	6,217,675
Change from prev. week, up			**8,075**	
Canada	†372,600		†372,600	†416,000
Total U. S. prod., Jan. 1-June 7			1,022,698,425 bbl.	
Same period last year (crude plus cond.)			*1,193,414,632 bbl.	

*Includes 22,459,750 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

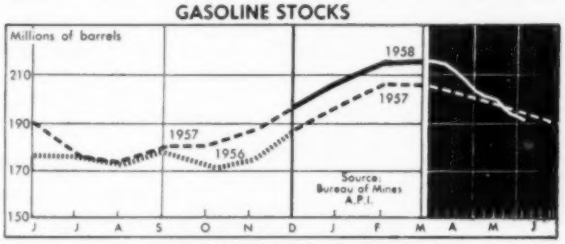
CRUDE-OIL STOCKS



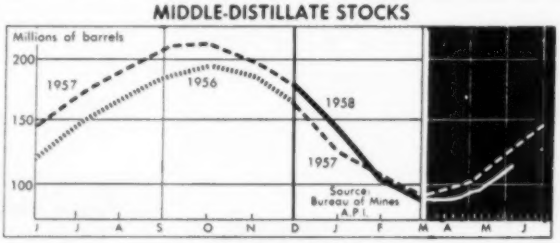
REFINERY RUNS



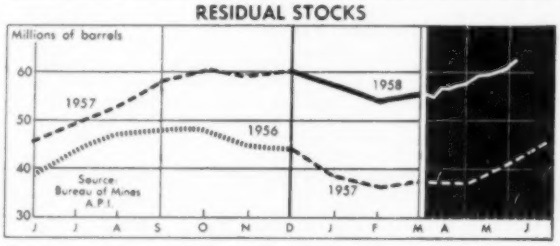
GASOLINE STOCKS



MIDDLE-DISTILLATE STOCKS



RESIDUAL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	5-31-58	5-24-58	6-1-57
Pennsylvania Grade	2,932	2,929	2,684
Other Appalachian	1,461	1,462	1,909
Illinois, Indiana, and Michigan	10,968	10,937	9,346
Nebraska and North Dakota	2,254	2,131	1,775
Kansas	10,467	10,741	10,826
Oklahoma	17,148	17,103	22,169
Arkansas	2,357	2,480	2,787
Louisiana	17,081	17,309	18,889
North	3,000	2,999	2,948
South	14,081	14,310	15,941
Mississippi, Alabama, and Florida	2,139	2,098	2,643
New Mexico	7,754	7,695	8,093
Texas	115,349	114,670	124,260
East Texas	7,519	7,867	11,831
West Texas	55,192	53,910	58,412
Texas Gulf	22,134	22,635	23,051
Other Texas	30,504	30,258	30,966
Wyoming	14,617	16,020	17,044
Other Rocky Mountain	8,080	7,637	6,134
California	39,594	39,541	26,407
Foreign	†16,593	17,072	14,158
Total	268,794	269,825	269,124

*Bureau of Mines. †Includes 4,872,000 bbl. in California.

API REFINERY REPORT, JUNE 6, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June 1957—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,131	516.4	22.6	287.0	179.7	44,813	8,739	28,958	12,675	1,210	498.0	21.3	300.8	223.2
Appalachian:														
District 1	95	43.0	4.9	22.0	5.6	4,681	548	2,079	592	101	44.7	3.2	20.7	4.6
District 2	108	59.6	2.9	25.3	10.3	2,555	354	1,000	381	58	34.2	3.6	7.6	7.3
Ind., Ill., Ky.	1,413	728.7	65.2	281.6	155.7	36,187	4,611	15,345	5,247	1,340	684.7	57.1	263.7	157.0
Minn., Wis., Dak.	107	51.9	9.7	24.4	9.9	6,695	998	4,487	541	99	47.7	6.9	26.4	8.1
Okla., Kans., Mo.	734	410.1	13.6	174.0	25.9	16,929	1,172	8,461	887	719	402.4	12.9	168.7	28.6
Inland Texas	248	180.7	7.4	37.3	17.0	6,821	357	1,422	2,045	275	204.8	9.4	51.5	21.9
Texas Gulf Coast	1,763	887.6	60.7	467.6	190.7	25,433	2,607	9,888	5,528	1,869	932.6	72.8	491.1	277.8
La. Gulf Coast	620	364.0	37.4	185.1	34.3	10,096	1,449	4,115	1,321	653	369.5	53.7	172.7	51.5
N. La. and Ark.	91	38.9	5.4	19.4	7.1	4,554	861	1,934	185	93	33.7	5.2	21.4	6.8
Rocky Mountain:														
New Mexico	20	8.0	1.1	4.1	2.7	611	20	145	68	27	13.4	.3	5.5	2.8
Other Rocky Mt.	279	132.0	4.4	59.6	33.4	6,566	193	2,649	966	292	137.4	2.2	65.6	32.8
West Coast	1,081	473.8	11.1	162.7	295.6	27,349	435	12,554	32,374	1,131	478.1	5.3	177.0	328.7
June 6, 1958	7,690	3,894.7	246.4	1,750.1	967.9	193,290	22,344	93,037	62,810	7,867	3,881.2	253.9	1,772.7	1,101.1
May 30, 1958	7,487	3,776.7	208.4	1,709.1	979.6	193,355	21,469	87,858	61,383					
June 7, 1957	8,080	3,995.1	286.1	1,780.0	1,191.6	193,298	26,148	101,789	41,246					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (89 octane)	11.75-12.00
★ Premium (99 octane)	14.75-15.00
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	9.75-10.25
Regular (92 octane)	10.00-10.50
Premium (97 octane)	11.375-11.75
Premium (98 octane)	11.875-12.50
California (rack) (Los Angeles):	
Regular (88 octane)	12.0
Premium (96 octane)	14.5
Premium (98 octane)	15.0
Caribbean area (cargoes):	
Regular (87 octane)	9.625
Premium (98 octane)	12.125

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.25-9.50
Diesel oil (58 d.i. and above)	8.875-9.125
Distillate No. 1	8.875-9.125
Distillate No. 2	8.25-8.50
Gulf Coast (cargoes):	
Kerosine 41-43	8.50-8.75
Distillate No. 2	8.00-8.25
New York Harbor (barges):	
Kerosine 41-43	9.35
Distillate No. 2	8.85
Diesel fuel, 48-52 d.i.	9.45
Caribbean area (cargoes):	
Distillate No. 2	8.125

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max 1% S)	$1.25-1.30
Gulf Coast (cargoes):	
Bunker C fuel	$2.20-2.25
New York Harbor (barges):	
Bunker C fuel	$2.57
Caribbean (cargoes):	
Bunker C	$2.25
California (rack):	
Bunker C fuel, Los Angeles	$2.45

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	24
200 vis. neutral (180° at 100°), 25 p.t.	22

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.47	....	....	....	....
15-15.9	2.52	....	....	....	$1.81
16-16.9	2.58	....	....	....	1.86
17-17.9	2.63	....	....	....	1.91
18-18.9	2.69	....	....	....	1.96
19-19.9	2.74	....	....	....	2.01
20-20.9	2.80	$2.75	....	$2.62	2.06
21-21.9	2.85	2.77	....	2.64	2.11
22-22.9	2.91	2.79	....	2.66	2.16
23-23.9	2.96	2.81	$3.44	2.68	2.21
24-24.9	3.02	2.83	3.46	2.70	2.26
25-25.9	3.07	2.85	3.48	2.72	2.31
26-26.9	3.13	2.87	3.50	2.74	2.36
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma (sweet), part of Kansas, North Dakota, W. Texas (sweet). Some Oklahoma available for 15 cents less starting 3-17-58 and other at 10 cents less on 4-1-58. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 4-14-58; east of California, January 3-10, 1957; Pennsylvania Grade 4-16-58.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.15
Middle District	3.97
Southwest Pennsylvania	3.68
West Virginia	3.50
Buckeye Grade	3.50
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.30
Lagunillas heavy, flat, Amuay or Las Piedras*	2.25
Bachaquero, flat, 15°-16°, Las Piedras*	2.08

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

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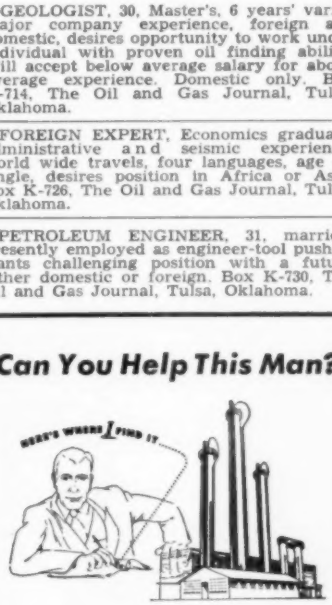

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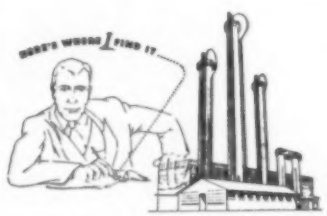

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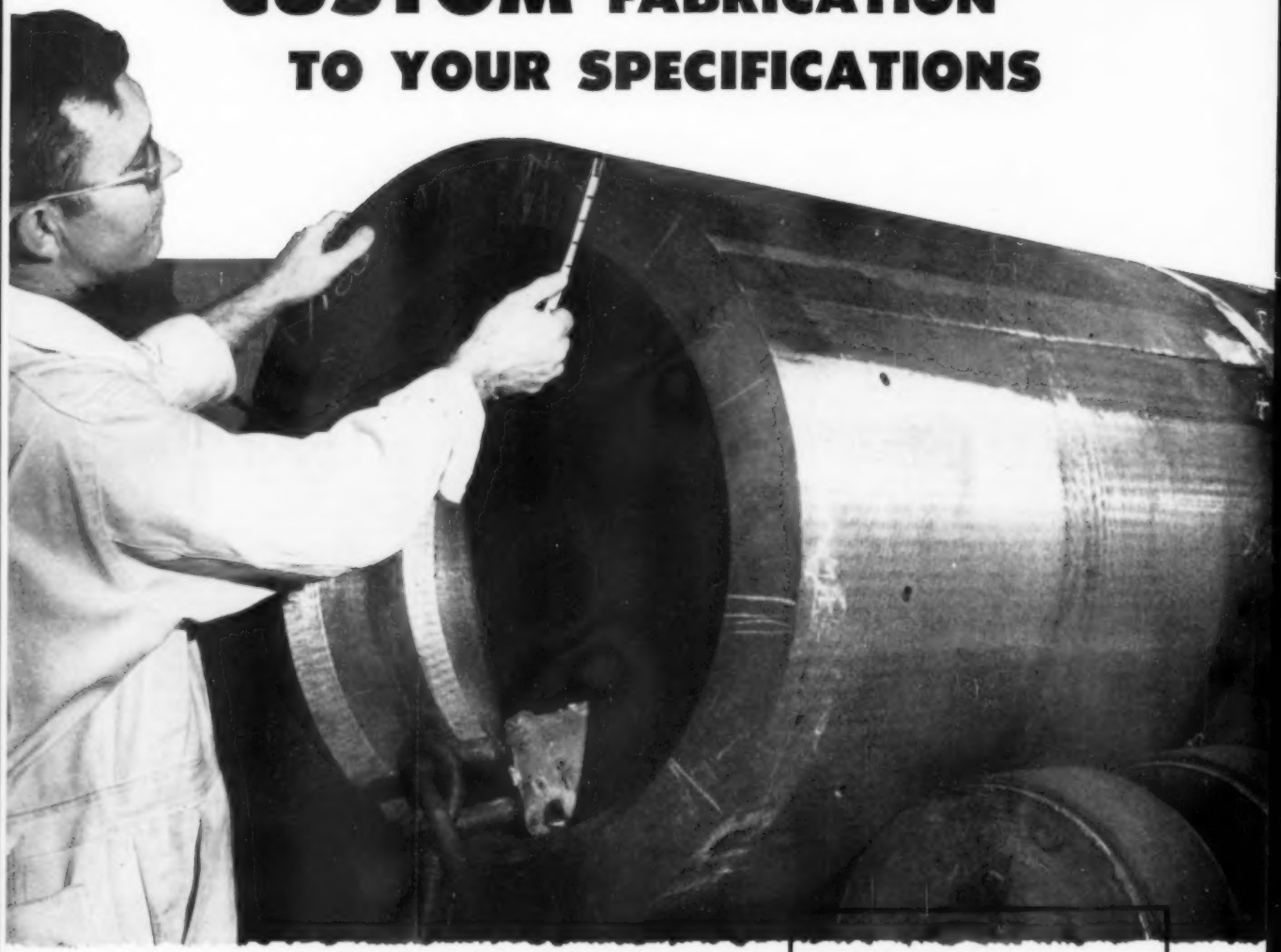

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